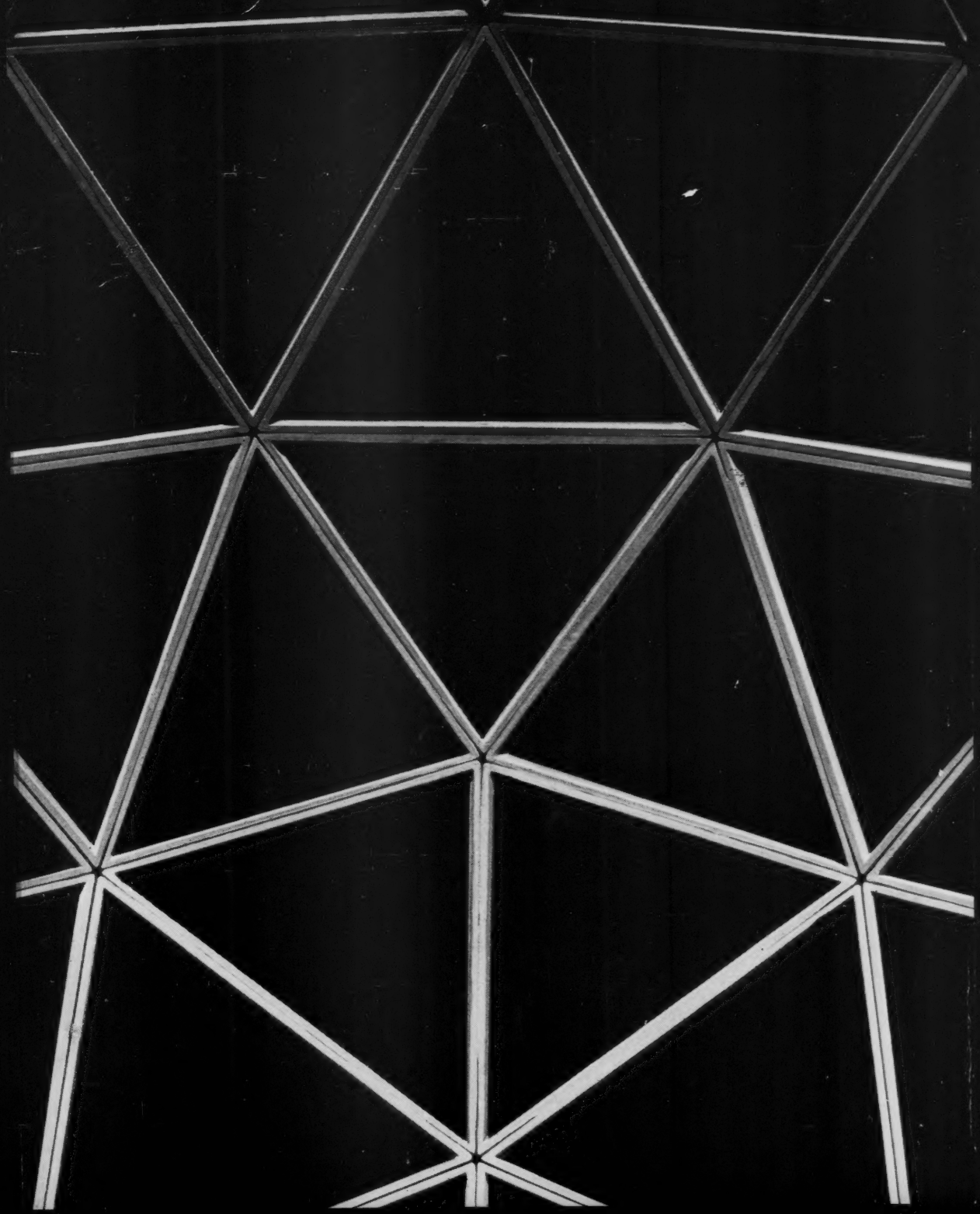
Design Engineering

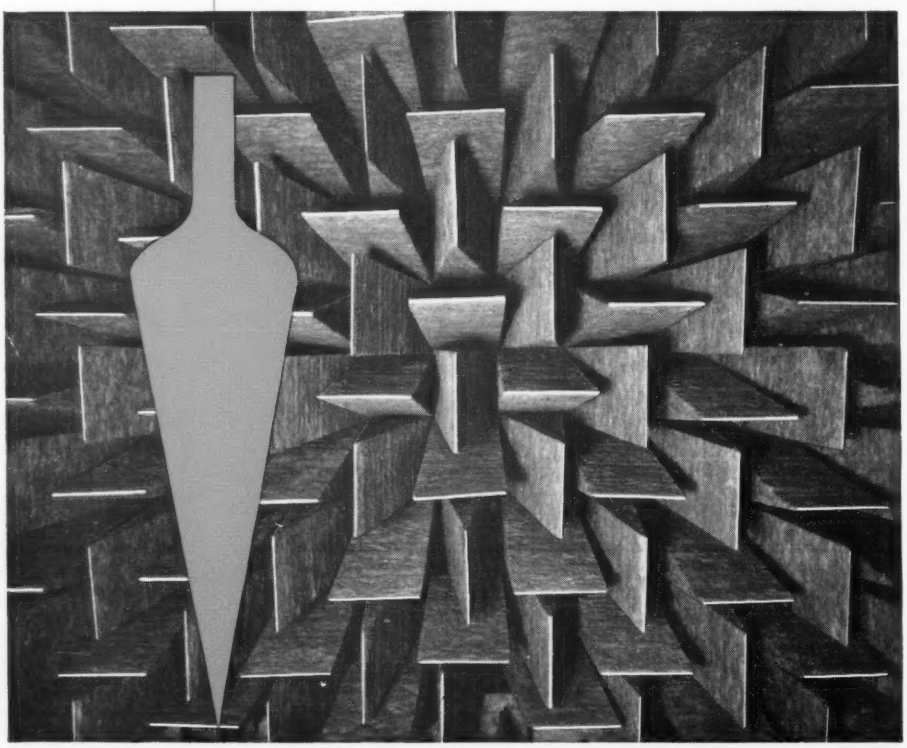
FIVE DOLLARS A YEAR PUBLISHED BY THE MACLEAN-HUNTER PUBLISHING COMPANY LIMITED, TORONTO, CANADA JUNE 1961



TO PLUMB NEW DEPTHS

IN SOUND, Northern Electric Research and Development Laboratories built a floating anechoic chamber. Although the appearance of this room is weird, its purpose is perfection; for here, there are no echoes, reflections or vibrations to distort the accuracy measurements of sound waves. ■ Wedges of Fiberglas, five feet long, project towards the middle of the room from all six surfaces, so that the equipment under test is completely surrounded by a mass of sound absorbent material. ■ This anechoic chamber is being used to test microphones, speakers, telephone transmitters and receivers, intercom systems and other communications equipment. ■ The chamber is an important new asset, but it represents just a fraction of the total facilities and personnel dedicated to the quest for progress in communications at the Research and Development Laboratories of Northern Electric Company Limited.

■ RESEARCH AND DEVELOPMENT LABORATORIES

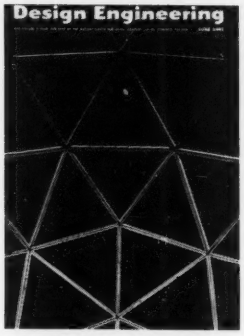


Northern Electric
COMPANY LIMITED

SERVES YOU BEST

6660-26

For further information mark No. 132 on Readers' Service Card



This month's cover

Designing a structure that would be stable, but without any internal supports or columns has been the aim of architects and engineers for many a moon . . . and now we have them in the form of geodesic domes. You can read all about the domes in our lead article this month. Cover picture is by Ron Vickers, ARPS, from a model dome supplied by Geodesic Structures Limited of Toronto.

In this issue

Departments

Reader Service

Before reading further, turn to the back of the book and tear out a Reader Service Card. Circle the numbers as you go and mail the completed card to us—no postage is required. We will take care of your requests immediately.

Pass your copy along so that others may enjoy this service—there are three cards.

AEL
AVIATION

AEL
INDUSTRIAL

AEL
MARINE
—
ELECTRONICS

AEL
HOSPITAL
&
MEDICAL

Knock on any door!

Aviation Electric Limited serves Canadian industry in five broad fields: Aviation, Industrial, Marine, Electronics, Hospital and Medical. Operating from one of the continent's most modern plants, AEL in these five categories offers industry specialized services that are second to no other — anywhere !

Here's what you will find behind these doors:

AVIATION — The Design, Manufacture, Overhaul and Repair, Sales and Service of: Flight instruments and accessories, Aircraft accessories and engine components, Wheels and Brakes, Bendix electrical components, Navigational devices and systems.

INDUSTRIAL — AEL specializes in all phases of industrial controls, including the design of controls to meet specific problems and the supply of electrical, hydraulic, pneumatic and mechanical control components. Services embrace design, manufacture, overhaul and repair, sales and service.

MARINE — Sales and Service, Overhaul and Repair of Bendix Radiotelephones, Depth Indicators, Depth Recorders, Radar Sets, Fish Finders, etc.

ELECTRONICS — Point to point V.H.F. & Microwave communications equipment and accessories, Antennas, Semi-Rigid Coaxial cable and electronic test equipment.

HOSPITAL & MEDICAL — Sales and service of the Caesium Teletherapy Unit and Radium Applicators designed and manufactured by AEL

Your enquiries are invited

The Bendix Corporation
Canadian Affiliate

AVIATION ELECTRIC
LIMITED

200 LAURENTIEN BLVD • MONTREAL

For further information mark No. 105 on Readers' Service Card

The staff

Printed and published by Maclean-Hunter Publishing Company Limited. Editorial and Advertising Offices: 481 University Avenue, Toronto 2, Canada. Horace T. Hunter, Chairman of the Board; Floyd S. Chalmers, President; Donald F. Hunter, Vice-President and Managing Director.

OTHER SERVICES: The Financial Post Corporation Service; Canadian Press Clipping Service; Commercial Printing Division.

Offices at 1242 Peel Street, Montreal 2; The Burrard Building, 1030 West Georgia Street, Vancouver 5; Maclean-Hunter Limited, 30 Old Burlington Street, London W.1, England.

Subscription rates: Canada $5.00 per year; two years $9.00; three years $13.00. Single copy price, $1.00. United States and Great Britain $10.00 per year. Other countries $20.00 per year.

Authorized as second class matter. Post Office Department, Ottawa.

The contributors

Newman

Sekely

George Sekely wrote his article on electronic computer solutions in English for this issue, but he could just have easily authored it in Hungarian or German. With a fluent command of all three languages he was an official interpreter in his native country, Hungary, prior to 1956.

Graduating from the Civil Engineering Technical University of Budapest he designed forestry roads and structures and a large industrial waste and sewage treatment plant. He arrived in Toronto at the end of 1956 and took a job as design engineer with Lazarides, Lount and Partners. The last eighteen months has been with IBM and he is now supervisor of the 704 computing centre, Canada's largest scientific data centre.

Campbell

Walter Irwin, who discusses powder metallurgy in this issue, was a Queen's engineering graduate who served with the Royal Navy during the war. On hanging up his uniform he joined Canada Metal Company in Toronto as a sales engineer and rose to the rank of assistant manager and vice-president. During his term there he was responsible for the development of several new processes including hot brass pressing, roto-cast centrifugal casting and continuous casting of bronze bars. Early this year he went to Metal Atomizing and Processing Company as president.

Out of office hours Walter spends much of his time in municipal affairs at Lorne Park, and is an active member of the First United Church at Port Credit.

Burch

Irwin

Ken Campbell believes his first encounter with anything technical was as a youngster when he tried to take the kitchen clock apart with a knife. He wanted to see what made it tick (literally) as he thought it housed a small bug.

A native of Toronto, he was educated at the Ryerson Institute of Technology. Unlike most of our contributors who are designers that write as a hobby, Ken is a writer who designs as a hobby. At present he is assembling a device for indicating film density while a portable darkroom is also taking shape on his drawing boards. His main aim: to write do-it-yourself articles on the two projects.

Bruce Newman, who writes about testing calibrated motors, got his first practical engineering experience inspecting military equipment during the war. A graduate of the University of Toronto, he joined Wagner Electric Division of Sangamo Company Limited straight after the war and, except for three years with Ontario Hydro, has worked in the engineering and design department ever since. He is now chief motor engineer.

While with Ontario Hydro he passed up an opportunity every good fisherman would envy. He worked in the north where there are almost too many fish for the streams, but he never developed a taste for the sport. Much of his spare time has been spent organizing the establishment of new churches.

E. T. (Ted) Burch is a man who is not happy unless he is writing. Ever since the end of the war he's been penning words for a living, and he enjoys sitting behind a typewriter even in his spare time. But he does not waste his time behind a typewriter. In his book "So I said to the Colonel" he captured some of his lighter impressions of life in the army.

After the war Ted was with a Winnipeg ad agency as copy chief. In 1950 he went into the advertising race on his own until he accepted a position as Ontario organizer of the "March of the Dimes" campaign. This he left in 1959 to work in the promotion department at Maclean-Hunter where he helps publicize, among other books, Design Engineering. In this issue he authored the article on Position Homing Instruments.

Another Success Story in

Spring Design

from the Case History Files of

WALLACE BARNES

This case history proves that specialized experience and creative engineering pay big dividends in the design and manufacture of springs, small stampings, wire forms and assemblies.

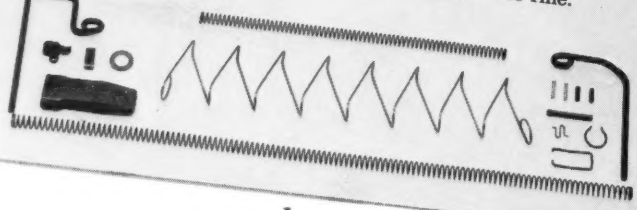
The engineering team at Wallace Barnes can very likely help cut your manufacturing costs, improve your product or help you solve a difficult design problem.

Take advantage of over 500 man-years' experience in spring engineering. We'd like to add *your* name to our success story files.

20 PRECISION SPRINGS FOR THE FN INFANTRY RIFLE

PROBLEM Before going into production on the F.N. Rifle, Canadian Arsenals were required to make recommendations for improvement and North American production. Springs played a most important part in the 700 rounds-per-minute firing action, and many of them had to be redesigned to perform efficiently in extreme heat areas within the rifle.

SOLUTION Wallace Barnes was consulted on the practicability of spring design and manufacture. Several design refinements and the use of heat-resistant spring metals for high heat areas were recommended by Wallace Barnes' engineering team. The results of this specialized spring engineering have been proved in the efficient performance of the rifle.



If YOU have a problem in Spring Design . . .

Wallace Barnes offers a complete service in the development and manufacture of springs, small stampings, wire forms and assemblies for every application.

A Wallace Barnes representative will be glad to discuss your problem, and the engineering team will help you solve it. Ask for your copy of our "Pocket Guide to Springs and Other Things."

Just call the man  from Wallace Barnes

The Wallace Barnes Company Ltd.

Hamilton, Ontario—Montreal (Pointe Claire) Quebec

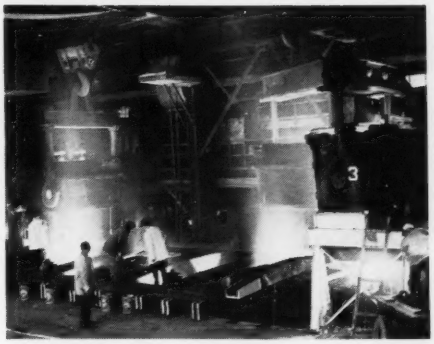
Sales Agent: E. A. Tipping Sales Ltd., Winnipeg—Vancouver (Richmond)

Associated Spring Corporation

64-238

For further information mark No. 152 on Readers' Service Card

The largest steel castings ever produced in Canada



When four giant ladles began pouring out 250 tons of white-hot molten steel in a Montreal foundry recently it marked the start of a million dollar order for the twelve biggest steel castings ever made in Canada. It was also the first quadruple pour ever accomplished in Canada and possibly only the second in the world.

One of the toughest tasks was co-ordinating the melting practices in four different furnaces. Time from the first heat tap to the actual pour was exactly 34 minutes. It then took three minutes for the 2800 deg F steel to fill the mould which was made from 300,000 lb. of sand.

Each of the twelve castings is to be 32 feet long, 14 feet wide and 38 inches thick. Individual weight is to be 300,000 lb. When finished they will be shipped to Dominion Engineering Works Ltd. where they will be used in the manufacture of rolling mills for Algoma Steel Corporation. *Source: Canadian Steel Foundries Ltd.*

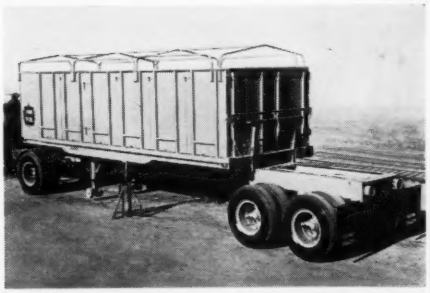
A new technique for producing better transistors

Better quality transistors should result from a new electrochemical process developed for rapid scratch-free polishing of germanium and silicon wafers. Up till now the big problem in manufacturing transistors has been maintaining an undamaged surface on the semiconductor slice used for the active element. But with the new technique the deep scratches, caused by lapping and polishing with the conventional method, will be conspicuously absent.

The secret is to mount the semiconductor slices on a nonconducting disk and make electrical contact before placing on a polishing wheel over which flows an electrolyte. As the wheel rotates the semiconductor slice is automatically separated at a relatively constant distance by a film of the electrolyte whose thickness is determined principally by its viscosity. Dilute potassium hydroxide is used as an electrolyte for germanium and dilute hydrofluoric acid for silicon.

Simple tests prove the process introduces no new damage to the surface. A mechanically polished surface shows distinct scratches when magnified 500 times, but slices electropolished show no texture that can be associated with surface roughness even under electron-microscope examination at 53,000 power. *Source: Bell Telephone Laboratories.*

Canada designs an efficient frameless, piggyback trailer

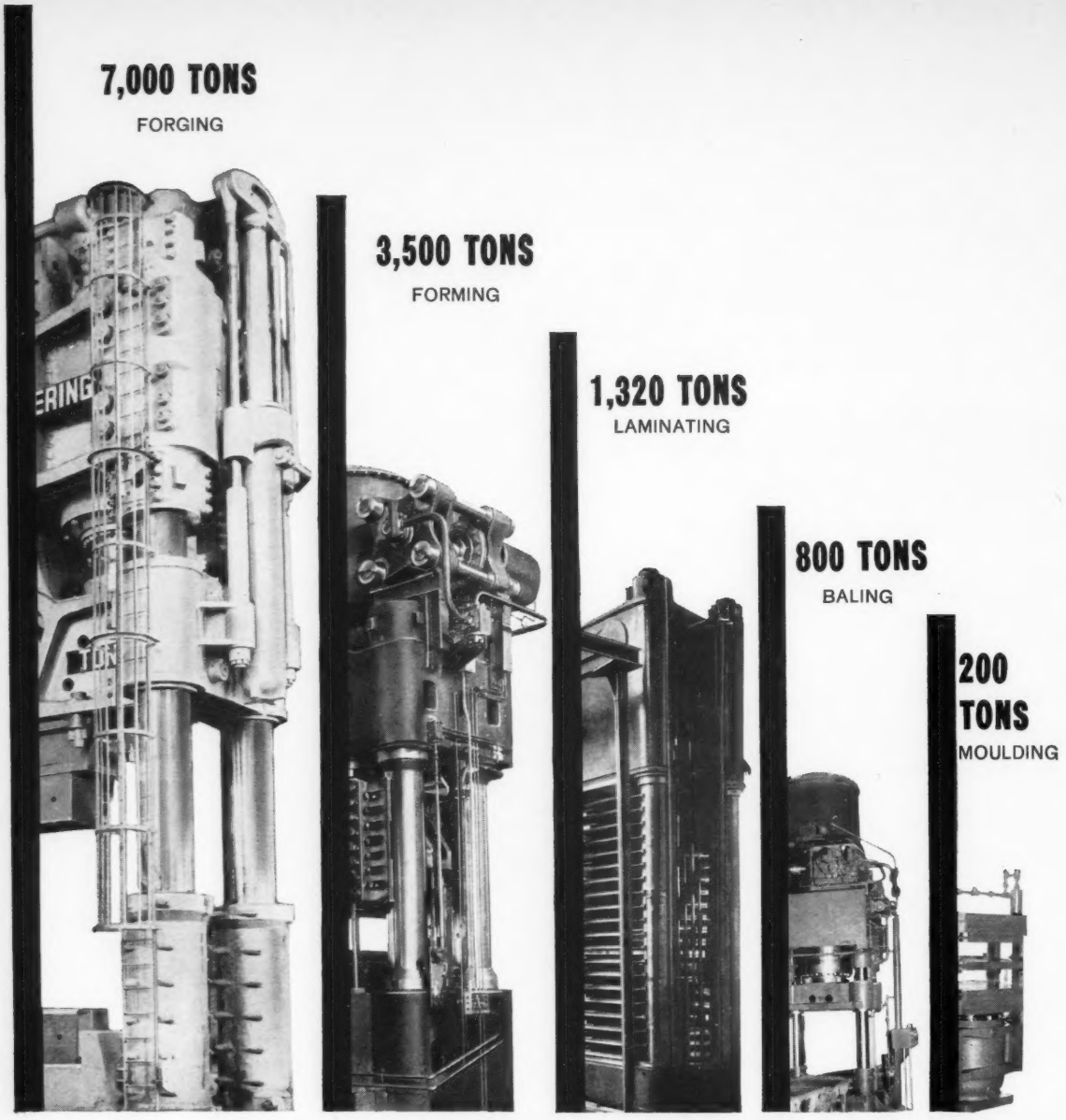


Canadian engineers have come up with a new idea to streamline integrated rail and road haulage operations. It is a newly developed frameless stake and rack, piggyback trailer to be put to work for Canadian National Railways.

Chief design feature is the positioning of the main rails on the outside of the trailer rather than in the usual center position. This eliminates trussing on the side rails and thus interference with the forks of travelling lift-cranes used for loading and unloading trailers from flat cars at the terminals. A special jig was designed to hold main rails and cross members during welding, ensuring true frames in each trailer and accurate positioning of bogie rails.

The tandem bogies are an entirely separate unit that can be installed in a matter of minutes. Change-over requires only a disconnection of electrical and air lines, removal of specially designed lock-pins and easing of the trailer's weight from the bogie.

The 24-foot-long trailers can carry thirty tons to allow two to be carried one some of the more commonly used flat cars. They are short turning and easy to handle in city traffic, and can be efficiently used for short highway runs. *Source: Highway Trailers of Canada.*



DOMINION HYDRAULIC PRESSES

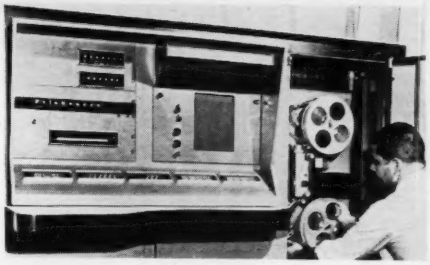
You benefit from 30 years' experience when you let Dominion design and build your hydraulic presses. Any size and capacity—any application. For full details on the widest range of Canadian-designed presses, please contact

PMR DEPARTMENT

DOMINION ENGINEERING COMPANY LIMITED
P.O. Box 220, Montreal, P.Q.
Toronto Vancouver

For further information mark No. 119 on Readers' Service Card

The fastest machine for scanning microfilm files

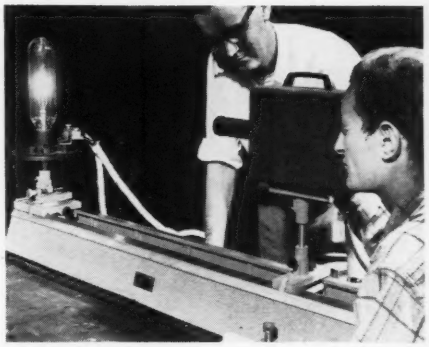


With well over 50,000 technical journals now being published in 60 languages, engineers and scientists are having to rely more than ever on fast reliable means of searching their files for wanted information. A new entry to the field of automatic storage and retrieval is a machine which can search a 32,000 page-file in about the time taken to drink a cup of coffee. Cost: $100,000.

Because it stores 32,000 standard-sized magazine pages on a single reel of microfilm it can accommodate a total of 1,600,000 pages of information in a single file drawer . . . something that would normally require 40 four-drawer file cabinets. When it receives an order to dig something out it scans 6,400 pages each minute, a rate of over three million pages in a day's work.

Requests can be handled six at a time and can be fed into the machine on punched cards. When the facts are located the relevant pages are flashed on to a projection screen. Hard copy prints can be reeled off immediately if necessary. *Source: FMA Inc.*

Extremely high temperature measurement can be accurate

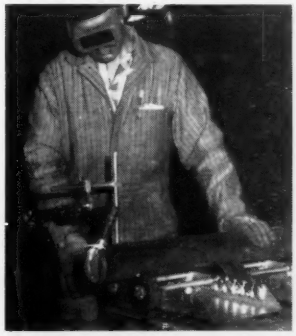


Reliable measurement and regulation of temperatures up to 4,000 degrees Centigrade has been made possible with the development of a new automatic pyrometer which can record changes to less than one degree.

About the size of a 16 mm movie camera, the pyrometer is mounted on a tripod in front of the heat source while a light bulb inside adjusts to the brightness. An electric current through the bulb provides a means of measurement. Temperature regulation is effected by a servo-mechanism connected to the power supply of the heat source and to a detector sensitive to the brightness of the bulb. The detector adjusts signals from the heat source and the light bulb until they have reached the same level.

Industrial applications for the new pyrometer will be found in ceramic factory ovens and steel mill blast furnaces. It may also be used as a research tool in the aerospace industry. Lending further weight to its importance is its capability of operating on a temperature range up to 10,000 C with a special attachment. *Source: Atomics International.*

A fast, simple method for cleanly cutting steel pipe



Small individual welding operators will welcome a method developed by a B. C. man for cutting steel. It not only cuts cleanly, eliminating grinding and filing, but is three to ten times faster than conventional manual methods.

The inventor, Bill Holinaty, uses a machine which is a system of rollers and axles that controls the course of the standard cutting torch. Weighing only 50 lb. it is easily portable and can be adapted for cutting loose or stationary pipe up to two feet in diameter.

The rollers and axles are mounted on two open-ended trays. A set of notches enables the rollers to be set apart at varying distances, while the axles are held in place by ordinary cupboard clamps.

Loose pipe, placed on top of the rollers and turned by hand, can be cut in less than two minutes. To cut stationary pipe, bars are mounted around the pipe, screwed to the base of each tray and locked in place by chain. The machine is rotated around the pipe, a process taking less than five minutes. *Source: R. A. Metcalfe, B. C. correspondent.*

New LET THIS KIT INTRODUCE YOU TO "POP"® RIVETS

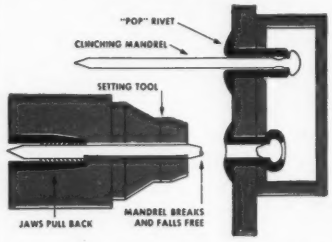
It Can SAVE Your Company Thousands of Dollars!

ONLY $19.95 PREPAID

Management men seeking a better, quicker and less expensive way to fasten products will put this idea Kit to work now in their design and methods engineering departments . . . where it can prove what thousands of companies already know — that "POP" Rivets can save over 50% on installed rivet costs — improve quality, speed production.

With this Kit your design engineers can experiment with simplified product design, study vibration effects, clearances, or fastener appearance. Methods or production men can try assembly-line changes on the spot. Time study analysts can make direct installation comparisons.

Assembled as an inexpensive means of introducing management to the "POP" Rivet fastening system, this new Kit contains everything needed — instructions, rivet assortment, hand pliers for setting rivets, — plus idea material.



How "POP" Rivets Work. They're installed and set from one side. A hollow rivet is preassembled on a solid headed mandrel which is used to set the rivet. Mandrel head is larger than end of rivet. When the head is pulled into the rivet with setting tool, the mandrel head clinches the rivet. Mandrel breaks near head under tension when rivet is set. Both hand and production power tools are available.

Order Your "POP" Rivet Idea Kit Now
Provide your staff with the advantages of a better blind riveting method. It can save thousands of dollars in fastening costs.

UNITED "POP"® RIVETS

"POP" RIVET DIVISION
United Shoe Machinery Company of Canada Limited
2610 Bennett Avenue, Montreal, Quebec

Attached Find ☐ check ☐ purchase order

for....."POP" RIVET KITS No. 100 @ $19.95 prepaid

NAME ..... TITLE .....

AFFILIATION .....

STREET .....

CITY ..... ZONE .. PROV. .....

For further information mark No. 149 on Readers' Service Card

Plastics have many advantages for countless components used in manufacturing today. At Smith & Stone we offer complete services for consultation, designing, engineering, tooling, moulding and finishing. Full facilities are available for compression moulding, injection moulding and extrusion. Let us show you what plastics can do for you.

SMITH & STONE LIMITED
GENERAL OFFICES: 50 ST. CLAIR AVENUE W., TORONTO, WA 3-5441
Sales Offices: Montreal, Toronto, Winnipeg, Edmonton, Calgary, Vancouver

For further information mark No. 140

To Better Serve Canadian Industry!

MANUFACTURING · SALES · ENGINEERING
MAINTENANCE · SERVICE

FARRIS PRODUCTS MADE IN CANADA

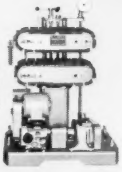
Safety Valves

Liquid Safety-Relief Valves

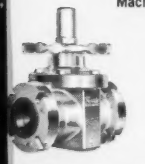
Process Safety-Relief Valves

Thermostatic
Float-Thermostatic
Thermo-Dynamic
Steam Traps

Universal Take-off Machines



Flexible Valves



Portable Hydraulic & Pneumatic Test Equipment

Boiler Door Mounted Oil & Coal Fuel Economizer

Odorless Smokeless Furnace Incinerator

from
FARRIS INDUSTRIES CANADA LTD.
LONGUEUIL, (MONTREAL)

To properly service the great Canadian industrial markets, Farris Engineering Corporation has formed Farris Industries Canada Ltd.

This Montreal manufacturing plant and office provides complete sales, engineering and maintenance service for all the famous Farris products.

It is a warehouse for all standard Farris Safety and Relief Valves, Flex-Valves, Mil Steam Traps, Universal Take-Off Machines, Universal Test Stands and Farris Fuel-Economizers. Its manufacturing facilities are used to maintain an inventory on these standard items. They are also used to produce "specials" on short order or to make slight design modifications on standard items to meet your specific requirements.

In just two decades, the Farris companies have gained world-wide renown as outstanding engineering-sales-service organizations.

This reputation has been earned by strict adherence to rigid manufacturing quality control measures, an intensive and continuing program of research and development and management's strong conviction and belief in the principle expressed by the Farris motto "Progress Through Honest Purpose."

COMPLETE VALVE REPAIR SERVICE

Farris Canadian facilities are geared for complete valve service, regardless of type. Safety, relief, gate, globe, reducing, plug valves and temperature regulators of any size can be repaired rapidly and efficiently by skilled mechanics in our completely equipped plant... and at money-saving prices. In addition, we meet your delivery dates... to keep your operations going without costly "down time."

Farris® INDUSTRIES CANADA LTD.

1150 Blvd. Marie Victorin • Longueuil (Montreal), Quebec • Phone: ORleans 7-9111

Farris® AFFILIATED COMPANIES

Serving Throughout The World

FARRIS INDUSTRIES CANADA LTD. Longueuil (Montreal), Canada

- **Hoskinson Multi-fuel Furnace Incinerators** -Converts all combustible rubbish into 500,000 BTU of **clean, odorless, smokeless** heat. Write for catalog.
- **All Farris Products**

FARRIS ENGINEERING CORP. Palisades Park, N. J.

- **Process Safety-Relief Valves** • **Steam Safety Valves**
- **Liquid & Special Service Safety-Relief Valves**
- **Universal Test Stands**
- **Hydraulic & Pneumatic Portable Test Equipment**

MIL DIVISION

- **Mil Steam Traps:** Thermostatic, Float-Thermostatic, Thermo-Dynamic
  Indestructible bi-metal control is immune to corrosion, frost, water hammer. Write for **catalog FE-310**

FARRIS FLEXIBLE VALVE CORP. Palisades Park, N. J.

- **Flexible Valves:** Hand & Air Operated Pinch Valves -Guaranteed not to plug. Full pipe capacity. Outlasts conventional valves 11 to 1. Write for **catalog FL-1116R**

FARRIS UNIVERSAL MACHINE CORP. Palisades Park, N. J.

- **Universal Take-Off Machines:** Plastic Extrusions, Cable Coating Pulling Equipment
  Resilient foam pads conform to any shape and take-off at infinitely variable speeds, without distorting or scratching product. Write for **catalog FU-110**

FARRIS COMBUSTION CONTROLS CORP. Palisades Park, N. J.

- **Fuel Economizer:** Door Mounted Oil & Coal Fuel Saving Device
- **Sayvoil:** Burner Mounted Oil Fuel Saving Device
  Saves up to 25% of fuel cost by preheating intake air up to 875° F. Fuel burns thoroughly without smoke or waste. Write for **catalog FC-2100** and **FC-3100**

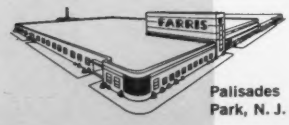
FARRIS ENGINEERING LTD. London, England

- **Process Safety-Relief Valves** • **Safety Valves**

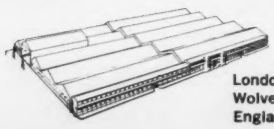
Associated Company:

MIDLAND INDUSTRIES LTD. Wolverhampton, England

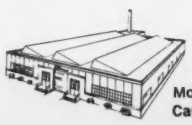
- **Steam Traps:** Thermostatic, Float-Thermostatic, Thermo-Dynamic



Palisades Park, N. J.



London & Wolverhampton England



Montreal, Canada

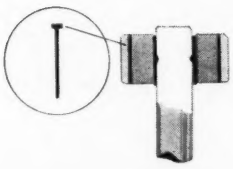
FIRST for supersonic jets . . .

NOW for industry . . .

"SCOTCH-WELD" BRAND STRUCTURAL ADHESIVES

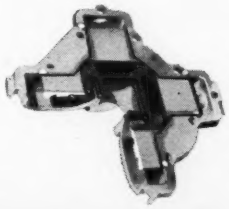
This amazing new "chemical welding" process enables you to fabricate without welds or rivets, solve design problems, and reduce parts assembly costs

Adhesive bonding of thin metal aircraft skins, metal braces, stiffeners and other parts was pioneered by the aircraft industry to develop stronger yet lighter, faster, higher flying planes. Certainly, if "Scotch-weld" Structural Adhesives are used to advantage in assembling multi-million dollar high-speed aircraft, they can also be used to advantage in load-bearing applications in many other industries. This modern, high strength method of joining metals, reinforced plastics and other materials, permits improved design and production techniques, cuts costs and offers many unique benefits . . . smoother contours . . . lighter gauge materials . . . reduced inspection . . . unusual combinations of materials, and so forth. Already, "Scotch-weld" Structural Adhesives have solved design and production problems for manufacturers of appliances, metal shipping containers, pneumatic tools, pumps, motors, scaffolding and many other items. They may be able to do the same for you. Mail the coupon and let us show you how.



Adhesive bonding small pinion gears to rotor shafts provided savings of $56.37 per thousand by reducing rejects, and eliminating secondary operations and the necessity for 100% inspection.

A pump manufacturer reduced rejection rates from a high of 25% to nearly zero by adhesive bonding three separate die castings to form a single part.



PRODUCT OF 3M COMPANY RESEARCH

MINNESOTA MINING AND MANUFACTURING OF CANADA LIMITED

LONDON, CANADA

. . . where research is the key to tomorrow

MINNESOTA MINING AND MANUFACTURING OF CANADA LIMITED
Box, 757, London, Ontario

Please send me complete information about the new "Scotch-weld" Brand Structural Adhesives.

NAME.....

COMPANY.....

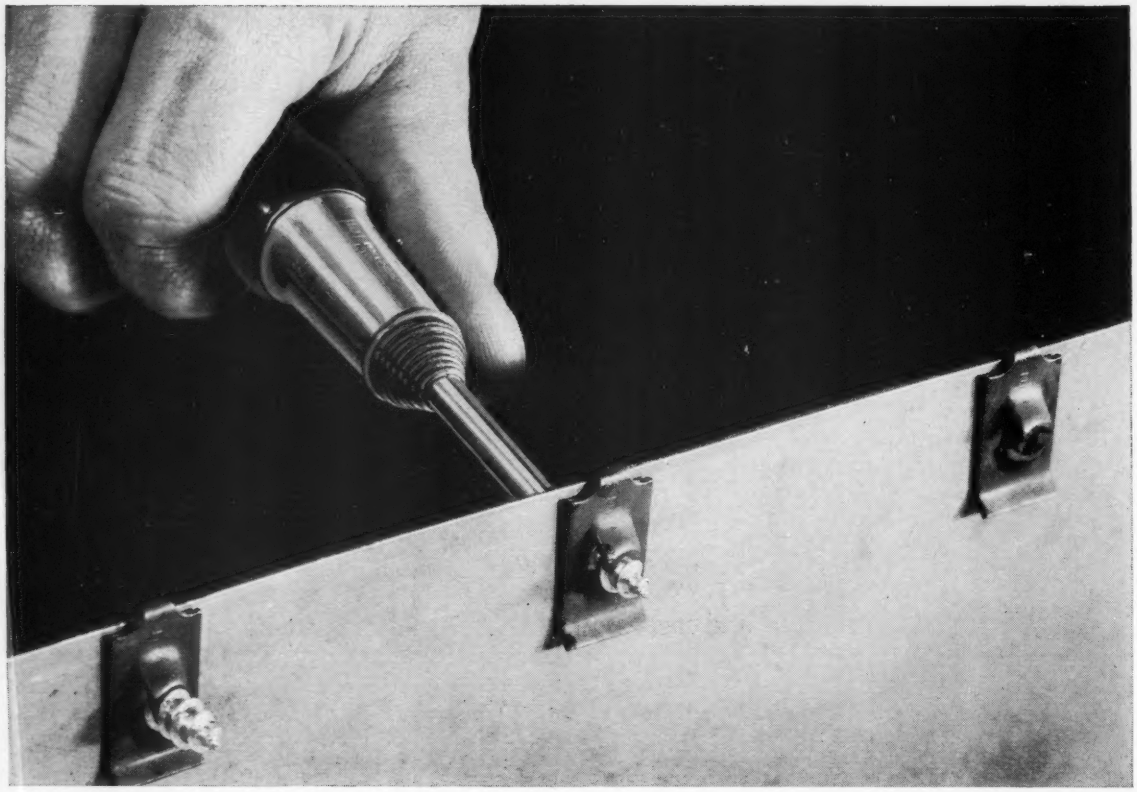
ADDRESS.....

CITY..... PROV.....

106305

For further information mark No. 130 on Readers' Service Card

Now, more than ever, it's time to cut costs



Speed Nut Fasteners give savings from 30% to 75% or more over other methods

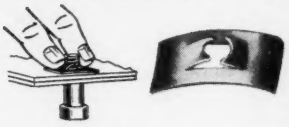
Competition for your share of the market is increasing from home and abroad. By reducing your product assembly time and lowering fastener costs you will improve your profit picture and make your product more competitive.

Dominion Fasteners Speed Nuts *will* reduce assembly time; *will* lower fastener costs; *will* improve your profit picture. Investigate the Speed Nut method of fastening.

For further information mark No. 120 on Readers' Service Card

Speed Nuts can save time and money in your assembly. There are over 8,000 types and sizes available

FLAT TYPES—*one piece, self-locking. Replace threaded nuts, lock washers and spanner washers.*

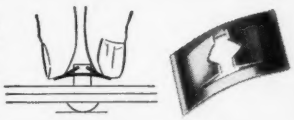


EXPANSION TYPES—*for fast assembly in blind locations where there is access to one side only. Snap by hand into square holes.*

DART-TYPE CLIPS—*dart portion compresses as it is snapped into hole, springs back to retain itself in place, or to lock panels together.*

SPEED GRIPS—*snap easily into bolt-receiving position without use of special equipment or skills; provide floating alignment.*

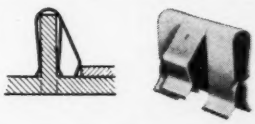
PUSH-ONS—*zip over unthreaded die-cast or plastic studs, rivets, nails, tubing or wire to lock parts securely.*



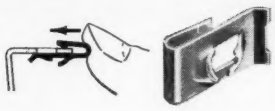
CABLE CLIPS—*snap in place by hand and hold themselves in position by "heel and toe." Easily removed for servicing.*

TUBULAR CLIPS—*for use with unthreaded studs or rivets on attachments where there is access to front side only.*

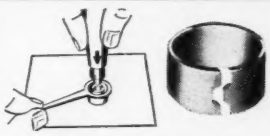
"U" AND "S" CLIPS—*for attaching metal, plastic or wood panels with a spring cushion. Eliminate holes in panels.*



"J" TYPES—*snap over edge of panels or into centre-hole locations. Hold themselves in place for blind assembly.*



COMPRESSION RINGS AND "C" CLIPS—*for attaching plastic knob-to-shaft assemblies. Faster permanent assembly is assured.*



"U" TYPES—*perform same function as "J" types, used where full bearing on lower leg of the Speed Nut is required.*

TUNING FASTENERS—*for better, faster mounting of radio coil forms. Hold core in position and provide tension on adjustment screw.*

Dominion Fasteners
FASTENING ANALYSIS SERVICE

Make us prove to you that Speed Nuts will cut your production costs. Our skilled engineers will take one of your finished units, disassemble it, study it piece by piece, and reassemble it using Speed Nuts where applicable. Then, in a detailed report, we will give you an accounting of the time and cost savings affected by the use of Speed Nuts. If there is not a fastener already produced that is suitable for your particular application, we will design one that is.

This fastening analysis service is free—take advantage of it today.

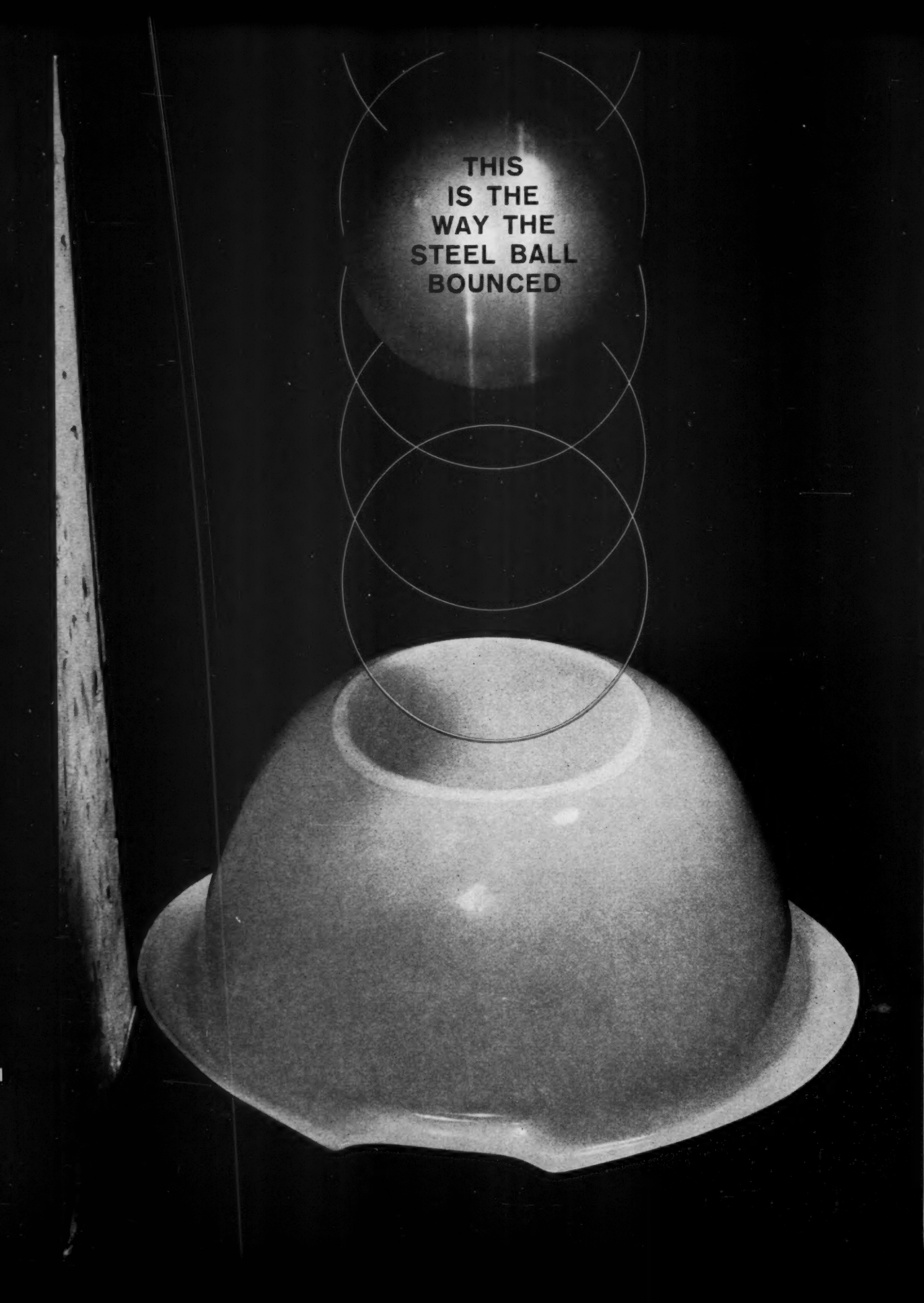
Write for full particulars:
DOMINION FASTENERS LIMITED
a Geo. A. Tinnerman *corporation*
Hamilton, Ontario
Sales Branches: Toronto, Montreal

DOMINION FASTENERS Speed Nuts

Exclusive TINNERMAN Canadian Licencee

33-608

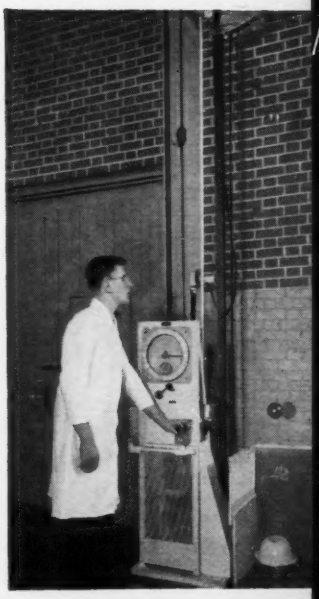
For further information mark No. 120 on Readers' Service Card


THIS
IS THE
WAY THE
STEEL BALL
BOUNCED

...ON DURABLE sclair BY DU PONT

DRAMATIC TESTS SHOW sclair POLYETHYLENE SUPERIOR IN USE

We began with two polyethylene materials — one of them SCLAIR. (Both materials have the same high impact strength according to standard ASTM lab tests). The two materials were moulded in the same mould on the same machine ■ Both products were tested by dropping a 10 lb. ball through a distance of 12 feet onto the gate area of the bowls ■ The products made from SCLAIR consistently withstood 10 or more impacts (the one pictured here withstood 14) whereas the other material split consistently on the first try. Why the difference? ■ The difference is in the superior mouldability of SCLAIR polyethylene. SCLAIR moulds readily — and a material MUST process easily to give a product good impact resistance. With SCLAIR the tendency to gate brittleness is greatly reduced, warping is minimized, and cycle times can be cut as much as 20%. In addition, appearance is enhanced by superb surface finish and excellent colour dispersion ■ This is only one of the tests we have made to illustrate how SCLAIR polyethylene can improve your product and reduce your costs. Ask your Du Pont of Canada representative for the full story on SCLAIR. Your enquiries will receive prompt attention.



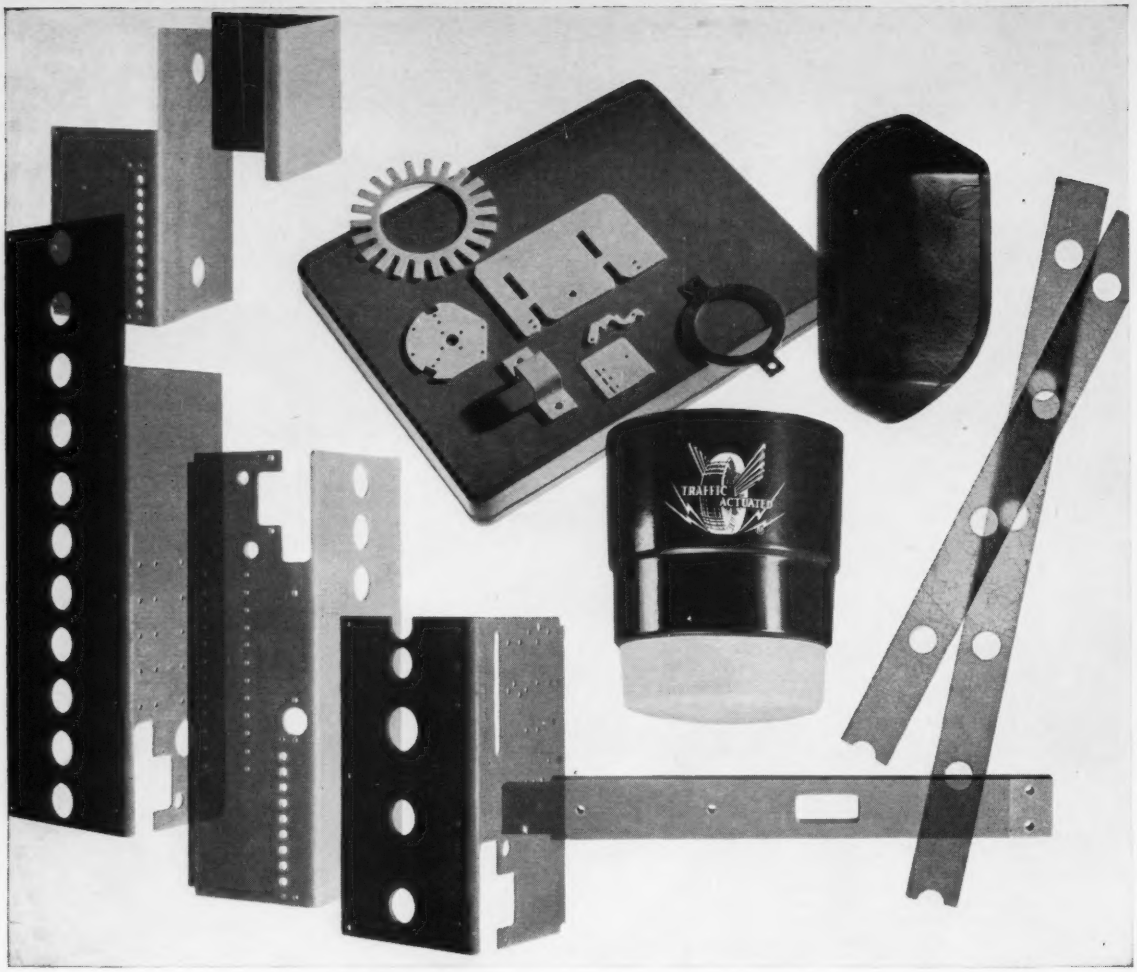
DU PONT CANADA

DU PONT OF CANADA LIMITED • Box 660, Montreal

*"SCLAIR" is Du Pont of Canada's trade mark for its polyolefin resins.

SCLAIR is produced in the world's newest, most versatile polyethylene plant

For further information mark No. 122 on Readers' Service Card



Have you explored the full design potentials of molded polyester-glass?

Few materials offer the designer so many opportunities for product design simplification and cost reduction.

Added to the inherent toughness and strength of polyester-glass are good electrical and thermal properties, weather resistance—and flame retardance if you need it.

Using advanced molding and machining techniques, complex shapes and structures can be produced to reduce product weight or the number of parts, eliminate costly machining or stamping operations, simplify product assembly, improve product performance, life or reliability.

These are the kinds of results our customers are achieving. For a few thought-starters—and facts about National polyester-glass products and molding services—contact your nearby National Sales Office, or write directly to Dept. N6, Toronto, Ontario.

116 Choices: One Source This is the latest count of the different plastics and grades National can offer in your search for the *one best material*. Add to this total *the* one special grade that can be developed from scratch to meet your particular need. This full range of materials is backed by complete engineering services . . . from application assistance up to and including the delivery of Canadian made, 100% usable, precision-fabricated parts . . . in any quantity, on time!

Call the National Sales Office near you. It's a direct line to single-source help on your current materials problem.

NVF

NATIONAL FIBRE CO. OF CANADA LTD.

Atlantic & Hanna Avenues, Toronto • 1405 Bishop Street, Montreal

For further information mark No. 131 on Readers' Service Card

Class B—a quality relay with exceptional endurance.

when long term reliability is important

Helpful selection data Class B series

CONTACT:
Twin independent

OPERATING VOLTAGE:
ac Max. 230 v., dc Max. 300 v.

OPERATING TIME:
.002 to .150 seconds

RELEASE TIME:
.005 to .600 seconds

Available with up to 20 springs per pile-up.

When you want a relay that will give absolutely reliable operation, for years and years of service, your best choice is Automatic Electric's famous Class B relay. The Class B is the most thoroughly tested and proven relay on the market, with a life often exceeding 400 million operations. Use it on computers . . . for pulsing or switching functions . . . for fast or slow operating requirements. For the most rigorous applications you can think of, you can rely on the Class B, always.

Extra compact design that makes possible important savings in space and weight, an extra heavy heelpiece that provides increased stability for spring pile-up, independent twin contacts and special pin type armature bearings, are just some of the Class B's unique features.

For endurance *and* reliability, the Class B is the finest relay available anywhere. Call or write Automatic Electric Sales (Canada) Ltd., 185 Bartley Drive, Toronto 16, Ont. Branches across Canada.

AUTOMATIC ELECTRIC
Subsidiary of
GENERAL TELEPHONE & ELECTRONICS

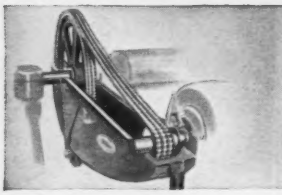
GENERAL SYSTEM

6021

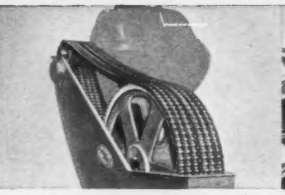
For further information mark No. 103 on Readers' Service Card

For standard products unmatched in quality and price . . .

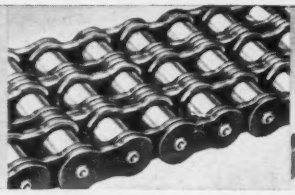
CALL RENOLD . . . FIRST NAME IN POWER TRANSMISSION



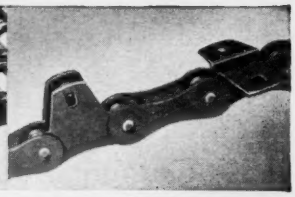
Renold B.S. Chain Drives—Stock delivery up to 140 h.p. Also wide range of standard cases and lubricators.



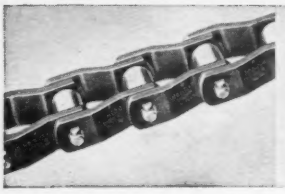
Renold B.S. Chain Drives—Prompt delivery up to 4000 h.p.



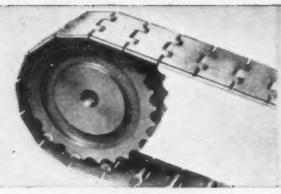
Renold A.S.A. Chains—a full range of single and multi-strand.



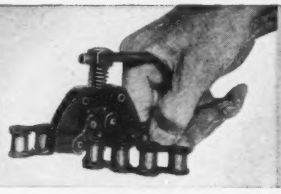
Coventry Steel Chains to replace malleable chains Nos. 32, 42, 50, 52, 55, 45, 62, 72½, 57, 67, 77, 75, 78, 88.



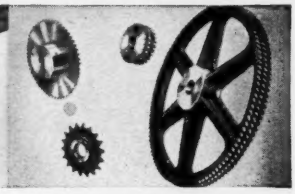
Renold Mark 3 Offset-Side Bar Roller Chains. Breaking loads 70,000 to 240,000 lbs. 2 in. to 5 in. pitch.



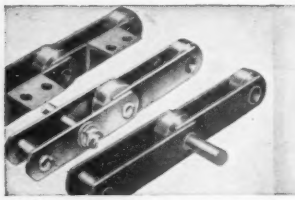
Coventry Slat Band Chains and wheels. Slats 3 in. to 7.5 in. wide. Stainless material or hardened mild steel.



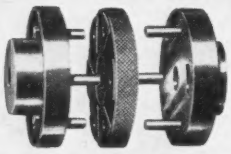
Renold Chain Tools—for easy chain installation and repair. All sizes.



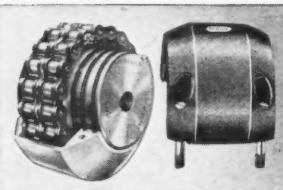
Renold Stock Wheels—Pinions and wheels are available for all Renold Chains.



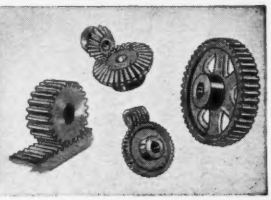
Renold Conveyor and Elevator chains. From 3,000 lbs. to 85,000 lbs. breaking load. Attachments and wheels.



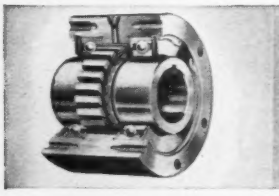
Renold Disc Couplings—Up to 600 h.p. Max. speed 3,600 rpm. Spider type to 20 h.p. Max. speed 10,000 rpm.



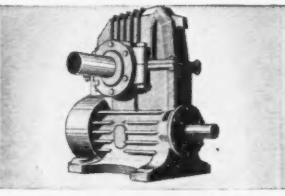
Renold Chain Couplings—11 sizes up to 1,500 h.p. Maximum speed 5,700.



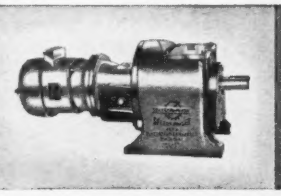
Boston Gears—Spur, worm and miter gears. Pinion wire and rack. All sizes.



Formsprag Clutches—Overrunning, backstopping and indexing. Standard and special sizes.



Reducers—Worm, helical and herringbone reducers. All sizes and ratios.



Geared Motors—Wide range from stock. Prompt delivery on larger sizes.

Catalogues—Write Advertising Department, 1306 Mountain Street, Montreal, P.Q.

RENOLD CHAINS CANADA LTD.

Branch Offices: Vancouver, Edmonton, Winnipeg, London, Clarkson (serving Hamilton and Toronto), Montreal, Quebec. Agents: E. S. Stephenson & Co. Limited, Halifax, N.S., Saint John, N.B., Hugh J. O'Neill Limited, Noranda, P.Q., Timmins and Sault Ste. Marie, Ont.

RENOLD CHAINS MANUFACTURING LTD. • BRANTFORD

RENOLD

CALL **RENOLD**... FIRST NAME IN POWER TRANSMISSION

For further information mark No. 136 on Readers' Service Card

THIS SURFACE REFLECTS QUALITY

The utmost in quality control at Noranda ensures that these coils of copper, brass and aluminum strip will have the uniform lustrous finish so necessary to the economical manufacture of components or finished products.

Annealing in these controlled-atmosphere Bell-type furnaces is but one of the many steps taken by Noranda to attain the highest standard of quality in all mill products. When you require mill products with the best possible surface for polishing, buffing or plating, your prime source is Noranda, whose equipment and production methods are unmatched.

Noranda control, which starts at the mine, through every stage of production, guarantees the finest copper and copper base alloys in rod, wire, strip and tube. We invite your inquiries for information or technical service.

THE KEY TO THE BEST IN METALS

Noranda Copper and Brass Limited

SALES OFFICES: Montreal • Toronto • London • Edmonton • Vancouver

Find the one drafting room need not supplied by Bruning!

It's the man at the board. Bruning furnishes everything else for the drafting room and architects as well as field equipment for the engineer. Only a few of hundreds of items are shown. Bruning Copyflex machines are backed by a full line of materials for making clear precise copies—Bruning also supplies over 100 varieties of sensitized papers, cloths and films as well as non-sensitized translucent tracing and writing paper, cloths and films.

Whether the order is large or small Bruning promptly answers your needs with top-quality service and supplies based on years of experience.

diazo

"FOR FAST, ECONOMICAL, VERSATILE COPYING"

CHARLES BRUNING COMPANY (CANADA) LTD.

37 Advance Road Toronto 18, Ontario

For further information mark No. 111 on Readers' Service Card

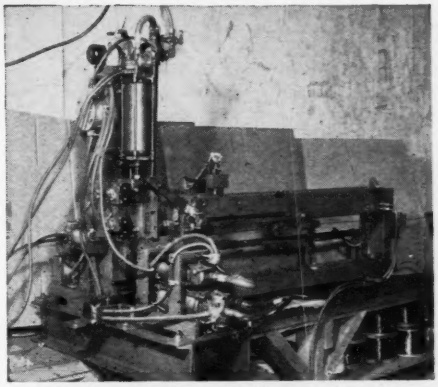
with the

BELLOWS AIR MOTOR®

After Neptune Meters, Ltd., Toronto, equipped its turret lathes with Bellows Air Motors, one man was able to operate two machines, production rose 2½ times.

...you can build special machines ...or modernize existing machines *at low cost and quickly!*

With parts normally available in every tool room, plus one or more Bellows Air Motors, and a little creative ingenuity, you can "spot modernize" scores of operations whose high cost whittles away at profits. The few illustrated here are typical of hundreds we can show you. The chances are good that no matter what you make, nor how you make it, this versatile air cylinder, with its *built-in* electrically controlled valve, can lend a mighty important helping hand to your cost reduction program.

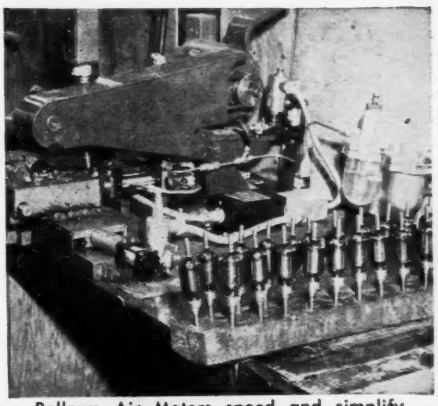


Built around Bellows Air Motors, this wire forming machine automates a slow, tiresome operation for Wilson Electric, Winnipeg reconditioner of motors and generators.

THESE BROCHURES MAY LEAD TO IMPORTANT SAVINGS IN YOUR PLANT

You're almost certain to get at least one new cost-cutting idea from these brochures. Bulletin BM-25 describes fully the Bellows Air Motor, illustrates and tells about many actual installations. "Spot-A-Mation Idea" File gives you diagrams, complete information and equipment lists which will enable your own men to automate scores of operations, quickly and inexpensively. For your free copies, write Dept. DE-661 Bellows-Valvair, Ltd., 14 Advance Rd., Toronto 18, Ontario.

676C-1



Bellows Air Motors speed and simplify polishing stainless steel "buttons" on electric motors for home appliances on this special machine at Sunbeam Corp. (Canada) Ltd., Toronto.

Bellows-Valvair, LTD.

14 Advance Rd.—Toronto 18, Ontario

For further information mark No. 108 on Readers' Service Card

Here's outstanding performance

WAGNER

TOTALLY ENCLOSED *polyphase* FAN COOLED MOTOR

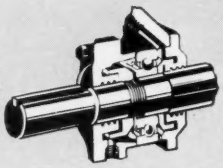
Long life, excellent torque characteristics, good full-load speeds, reliable protection—these are the characteristics built into these Wagner totally enclosed polyphase fan cooled motors.

Long life! Take for example the bearing lubrication. The transverse greasing system pushes out all "old" grease that might contain grit and cleanses the bearing with fresh grease. Rugged! We have heard it said that these Wagner 256U frames are built like a smithy's anvil. And the rotors are one piece—no chance for the fan to vibrate loose. And, speaking of fans, these Wagner motors run *COOL*.

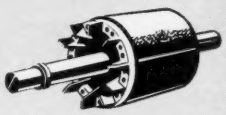
Full load speed is good. For example, a 4-pole motor would run between 1750 and 1765 r.p.m. *fully loaded!*

It is a fact, Wagner motors will give you years and years of outstanding performance.

The Wagner TOTALLY ENCLOSED motors have moisture proof gaskets between the conduit box and frame and under the conduit box cover. A special compound is used to completely seal off the leads.

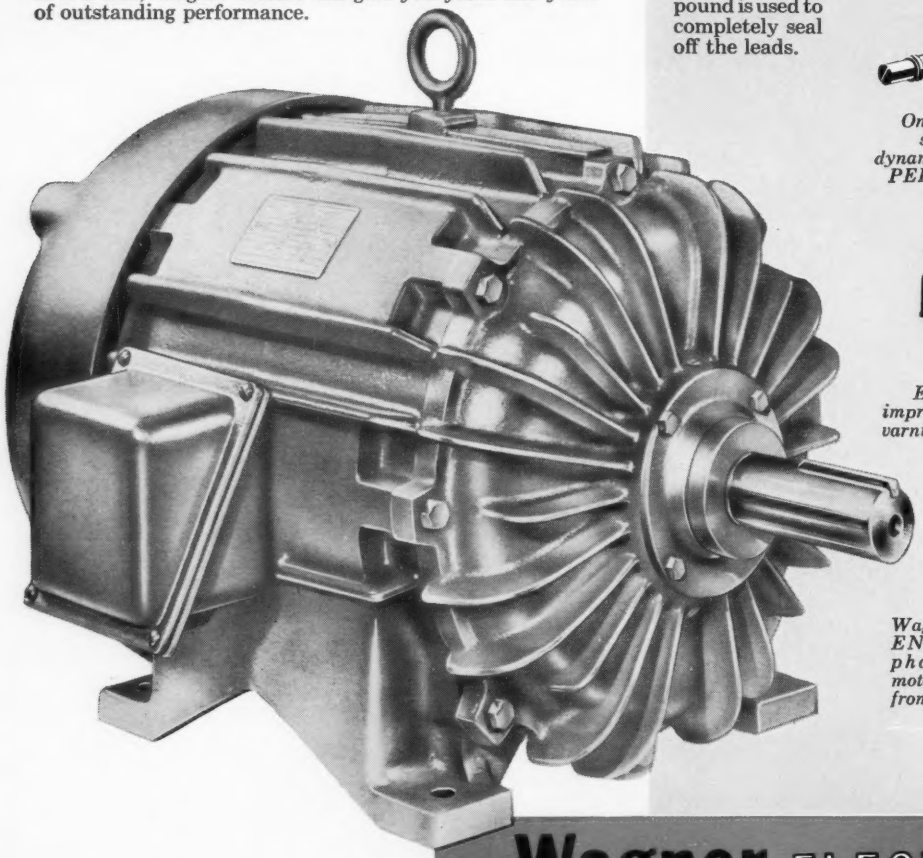


Transverse greasing adds years of trouble-free operation. A Wagner exclusive.



One piece rotor is statically and dynamically balanced—PERMANENTLY.

Entire winding is impregnated with Harvel varnish—moisture proof.



Wagner TOTALLY ENCLOSED polyphase fan cooled motors are available from 1 to 20 H.P.

1029

Wagner Motors are designed, engineered and manufactured in Canada

Wagner ELECTRIC

(DIVISION OF SANGAMO CO. LTD.)

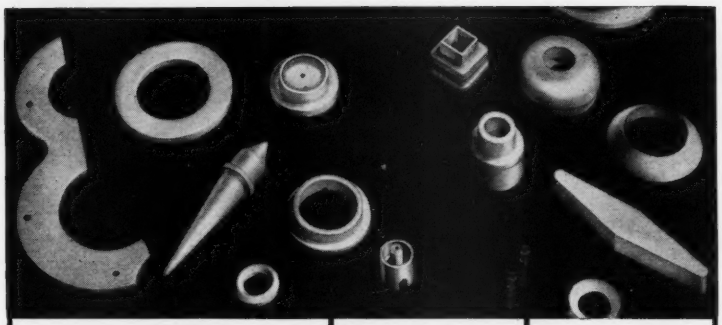
HEAD OFFICE: LEASIDE, TORONTO 17, ONT.

PLANTS: LEASIDE, ONT., TROIS RIVIÈRES, P.Q.

SALES OFFICES: TORONTO, MONTREAL, WINNIPEG, EDMONTON

For further information mark No. 151 on Readers' Service Card

PLASTICS
in Design Engineering



PROPERTY	TEFLON (TFE)	TEFLON (FEP)
Specific Gravity	2.1-2.2	2.1-2.2
Tensile Strength, 73°F	2500-3000 psi(a)	2700-3100 psi
Elongation, 73°F	100-200%	250-330%
Compressive Stress at 1% Offset	1000 psi	700 psi
Impact Strength, Izod Notched, 77°F	3.0 ft. lb./in. of notch	Does not break
Heat Distortion Temp., 66 p.s.i.	270°F	162°F
Coefficient of Linear Thermal Expansion (Approximate Values per °F)	5.5×10^{-5} in./in./°F	5.23×10^{-5} in./in./°F
Dielectric Strength, Short Time, 1/16"	400-500 v/mil(b)	400-500 v/mil(b)
Surface Arc-Resistance	700 seconds(c)	165 seconds(d)
Volume Resistivity	$>10^{15}$ ohm-cm.	2×10^{15} ohm-cm.
Dielectric Constant (60 Cycles)	2.0	2.2
Service Temperature Range (Max.)	+500°F	+400°F
Service Temperature Range (Min.)	−395°F	−395°F
Water Absorption	0.0%	0.0%
Flammability	Nonflammable	Nonflammable

(a) Tensile strength in oriented film may be as high as 15,000 psi.
(b) Value is 1000-2000 v/mil in thicknesses of 5 to 12 mils.
(c) Does not track.
(d) Samples melted in arc after 15 seconds, but did not carbon track.

This table compares the properties of Teflon* TFE and FEP. The newer FEP can be injection molded. In designing, consult your Garlock plastics specialist for best application results.

In designing intricate parts, consider the benefits of Teflon as a material.

Teflon offers a unique combination of properties unmatched by other plastics. It possesses the lowest coefficient of friction, the best non-stick characteristics, the most complete chemical resistance and the widest useable temperature range available in any plastic. Teflon eliminates lubrication, corrosion, contamination, seizing; it reduces friction, wear, space required, weight. Teflon can be used in a thousand different ways—for packings, gaskets and seals . . . for connectors, insulators, and test points . . . for valves, bearings, couplings, and insulation.

In producing intricate Teflon parts, consider the benefits of Garlock as a supplier. From virgin powder to finished piece, Garlock closely controls each step in the process to assure that the final part performs to your expectations. Complete facilities are at your disposal for molding, extruding, and machining of Teflon. If your application calls for special properties, Garlock will compound Teflon with selected fillers to greatly extend its service range. If you need unusually large configurations, Garlock will fusion-weld Teflon . . . the weld will have the same thermal, chemical and electrical properties as the Teflon itself.

Parts made from Nylon, Delrin*, C.T.F.E., Lexan† are also available from Garlock. Let your local Garlock representative quote on your design, or ask his assistance on any design problems concerning materials and applications. Call him at the nearest of the 26 Garlock sales offices throughout the U.S. and Canada. Or, write for Catalog AD-177. Garlock of Canada Ltd.

GARLOCK

General Offices: Toronto, Ont.

Branch Offices: Hamilton, Montreal, Winnipeg, Edmonton, Vancouver

Plastics Div.: United States Gasket Company

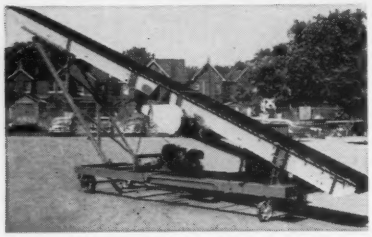
Order from the Garlock 2,000 . . . two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.

*DuPont Trademark
†General Electric Trademark

For further information mark No. 126 on Readers' Service Card

ALBION CASTER NEWS

IDEAS THAT MAY BE HELPFUL TO YOU — PRESENTED BY YOUR ALBION DISTRIBUTOR



HOW TO MAKE A PORTABLE CONVEYOR STAY PUT — Easily done with firm gripping Albion toe-operated wheel brakes fitted to rugged Albion "TT" Casters as used on this portable conveyor for handling bagged sugar. **No. 61201.**

High Capacity Albion Caster For Slow-Moving Equipment

Designed for high capacity, slow speed requirements, this Series 91 Super Duty Caster has a capacity of 8,000 pounds when equipped with Timken bearings or 4,000 to 6,000 pounds with Hyatt type bearings. Drop-forged steel wheels for use on this caster are available in sizes from 6" to 10" diameter, 2½" to 3" width. **No. 61202.**

Albion Caster With 101 (or more) practical uses

For special attachment problems, an angle iron bracket can easily be welded to the forged steel top plate. This provides a simple, economical solution for attaching casters to benches, scaffolding, racks, etc. Albion casters more than meet your requirements for all phases of service . . . and price. **No. 61203.**

WANT MORE DETAILS?

Just check the item number below and mail this coupon to:

UNITED STEEL CORPORATION LIMITED,
58 Pelham Avenue, Toronto 9

☐ No. 61201 ☐ No. 61202 ☐ No. 61203
☐ No. 61204 ☐ No. 61205

NAME.....

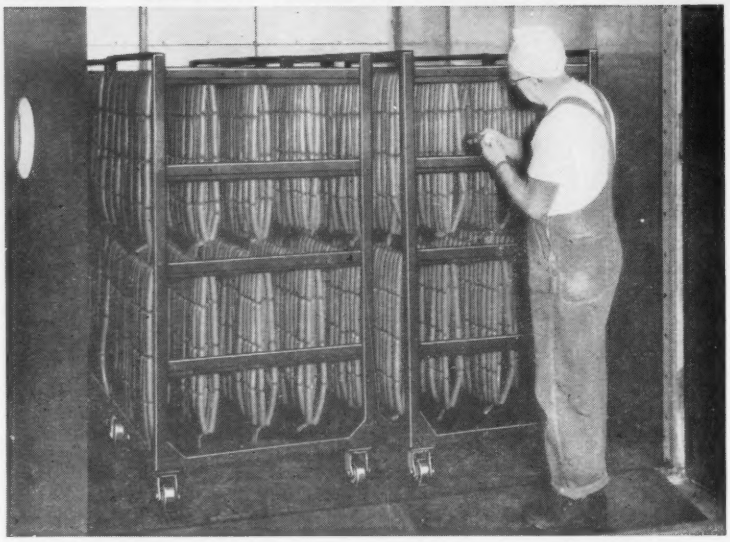
TITLE.....

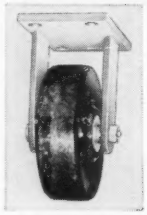
COMPANY.....

ADDRESS.....

CITY or TOWN.....PROV.....

NEW SANITARY CASTER RUNS CLEAN— STAYS CLEAN — MEETS INDUSTRY CODES





THE NEW ALBION SANITARY CASTER

A complete line of Albion sealed sanitary casters, developed specifically for food handling and processing plants, hospitals, pharmaceutical houses and other places where cleanliness is essential.

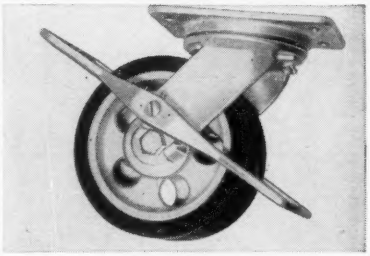
The unique new design of these casters makes sanitary maintenance simple and easy. The need for periodic lubrication due to grease loss or entry of foreign matter has been eliminated.

All Albion Sanitary Casters are supplied with straight-sided, molded Texite wheels. Texite wheels combine high capacity with the advantages of better floor protection. Albion Sanitary Casters resist mild acids, operate perfectly in almost any temperature range and remain clean, smooth and sanitary. **No. 61204.**

YOUR LOCAL ALBION DISTRIBUTOR OFFERS FAST, ONE-SOURCE SERVICE

He's a materials handling expert with the right Albion caster for your mobile equipment needs . . . probably available in stock. You'll find him listed under "CASTERS" in the Yellow Pages. Call him with confidence for the finest service.

NEW TREAD OUTWEARS RUBBER UP TO 5-TO-1



Alathane is the name of a new polyurethane elastomer material that has the load-carrying capacity of steel wheels plus floor protecting qualities, quietness and resilience. Alathane wheels have many times the abrasion-resistance of rubber or plastic wheels and are chemically inert, non-sparking, non-conductive and noiseless. 6" to 12" wheel diameters — swivel or rigid casters. **No. 61205.**

Albion Caster Division

60-120

United Steel
CORPORATION LIMITED

For further information mark No. 148 on Readers' Service Card

Design Notes on Fluid Power

RELEASE NO. 10: "How Pressure Switches Can Save Time and Money"

There are many jobs which can be done by today's pressure switches, to reduce cost, increase safety, prolong equipment life, and protect expensive mechanisms. Here are a few examples.

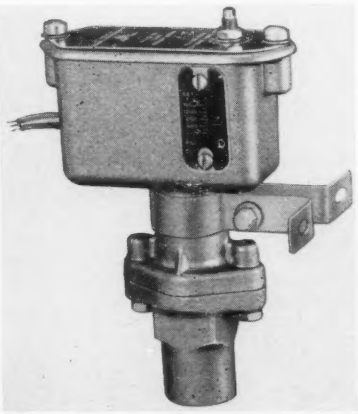
When filters are clogged, it takes more pressure to force the fluid through them; by measuring this pressure, we can determine precisely the moment when a cleaning or element change should take place. A pressure switch designed to sense "pressure difference" can be set to alarm at the desired degree of pressure drop. Thus you avoid the dangers associated with excessive filter contamination, without the expense of too frequent maintenance checks.

Liquid level control is another job that pressure switches can do very nicely. A typical installation has been working successfully at a remote, unattended diesel-generation station in Canada. A small tank in the building, adjacent to the engine, is fed automatically from the main storage tank outdoors. Pressure switches control the level in the small tank, starting and stopping the transfer pump automatically. Provision is made also for a standby pressure switch to a) take over control if the main switch fails and b) send an alarm to the nearest monitor station to warn of the malfunction.

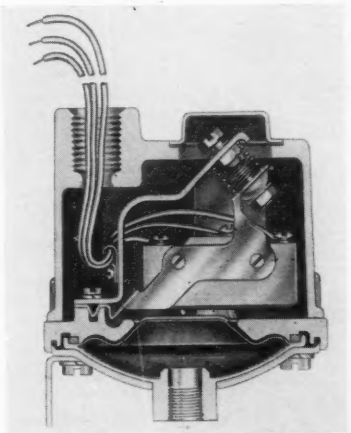
Since flow through an orifice results in a drop in pressure across the orifice, we can use pressure-difference switches to respond to high flow, low flow or no flow. A similar installation will discriminate between a liquid and a gas flowing through a line.

Another set-up was used on a pneumatically-operated gate, to prevent the gate being closed against a jammed object. By interlocking the circuits of a pressure switch and a limit switch, we can discriminate between the fully-closed position and an intermediate jammed position.

This is an opportune time to announce a new diaphragm pressure switch now in production at Barksdale Valves. A cutaway view is shown below. The modular design approach enables the customer to get a large number of different assemblies using standard subassemblies, contact elements, capsules, terminal block housings and explosion-proof housings. The proof pressures have been increased while accuracies have been bettered. This new switch is a radical improvement over previous designs, and is well worth the trouble of circling the code number to receive further information.

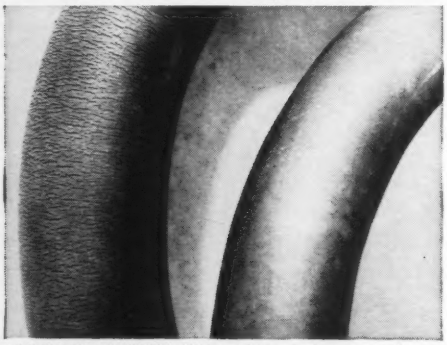


Barksdale C9612 and C9622 Piston-type pressure switch, recommended for heavy-duty service. Available for proof pressures up to 7000 psi, and operation up to 3000 psi, for oil, water, air and gas. Model 9653 is a pressure-difference switch which can withstand proof pressures up to 7500 psi, yet respond to pressure differences as low as 20 psi.

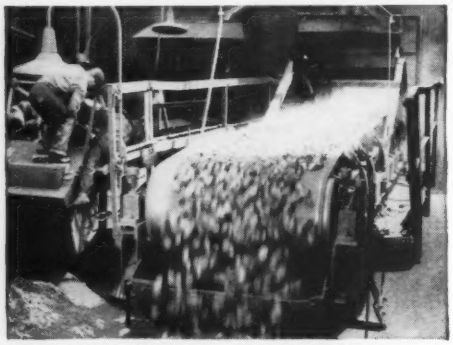


Barksdale Valves' new diaphragm pressure switch. The D1 series, single switching element, and D2 series, dual switching element, have proof pressures up to 600 psi, can be used on many installations presently requiring more expensive bourdon-tube models. Standard accuracy is ±0.5% with ±0.2% available on special order. CSA approval will be applied for as soon as possible.

OIL RESISTANCE—Pump hose resists gasoline; neoprene cover withstands weathering, swelling, and tendering upon exposure to oils, grease, most solvents.



SUNLIGHT RESISTANCE—Cable jackets tested outdoors for over 24 years. Cable at left is natural rubber; shows cracks. Neoprene cable at right is lively and tough.



HEAT RESISTANCE—Conveyor belt handles hot coke without failure. Neoprene products resist temperatures in range of 176°F to 250°F. Even higher temperatures for brief periods.

LOW COMPRESSION SET—Gaskets of neoprene in compression have good resistance to permanent deformation under loads. Retain sealing properties; resist oils.

Du Pont Neoprene offers you properties that meet a wide combination of product requirements

In addition to toughness and resilience, Du Pont neoprene synthetic rubber has many other desirable built-in physical characteristics. It resists oil, grease, sunlight, weather and deterioration from ozone, heat and years of aging. Neoprene's properties can be varied to give the right combination of the characteristics required. For example, in addition to properties pictured at the left, neoprene offers:

SOFTNESS-HARDNESS—neoprene compounds can be made to meet many service requirements. It's also available in sponge form, open cell or closed.

TOUGHNESS-DURABILITY—neoprene resists abrasion, cutting, chipping, wear and tear.

AIR RETENTION—neoprene has low permeability to gases . . . retains those that diffuse through rubber.

RESILIENCE—compares favorably with natural rubber and is extensively used in engine mounts and other vibration applications.

LOW TEMPERATURE RESISTANCE—properly compounded neoprene products retain flexibility at temperatures as low as —67°F.

FLAME RESISTANCE—neoprene won't support combustion. Compounds cease burning when flame is removed.

OXYGEN, OZONE RESISTANCE—neoprene's superior resistance accounts for excellent aging properties.

For your regular copy of "Elastomers Notebook" and more detailed information on Du Pont synthetic rubber products, write to Du Pont of Canada Limited, 85 Eglinton Avenue East, Toronto 12, Ont.

DU PONT CANADA

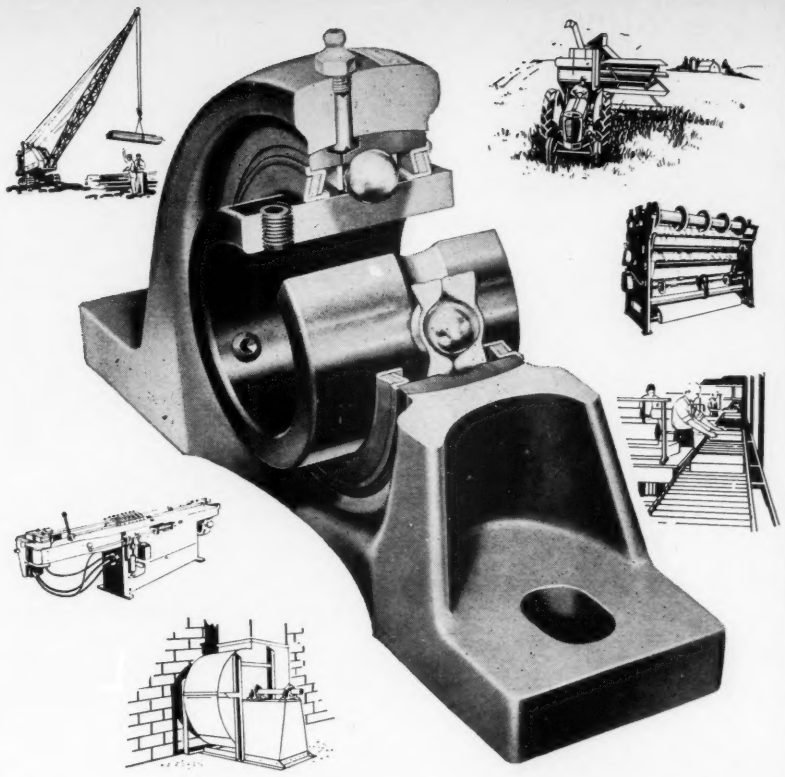
Better Things for Better Living . . . *through Chemistry*

SYNTHETIC RUBBER

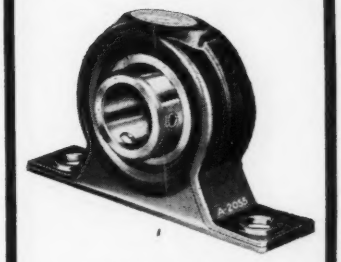
NEOPRENE
HYPALON*
VITON*
ADIPRENE*

**Registered Trademark of E. I. du Pont de Nemours Co. (Inc.)*

For further information mark No. 123 on Readers' Service Card



"LP" PILLOW BLOCK



RUBBER MOUNTED PILLOW BLOCK

SEALMASTER®

...quality that builds acceptance!

There is no greater assurance of performance than quality. SEALMASTER gives you that quality in a complete line of ball bearing units, providing a wide range of mountings in shaft sizes from ½" to 4 15/16".

Patented SEALMASTER "Zone Hardening" affords simplified, secure locking to shaft. One piece housings eliminate loose pieces that increase your assembly costs. And when cost is a primary requisite there's no need to sacrifice quality.

The new SEALMASTER "L" Series provides a precision, low-cost line of self-aligning ball bearing units. They are permanently sealed and pre-lubricated with a high grade lubricant for long life.

SEALMASTER rubber mounted units provide extremely quiet operation where noise is an important factor.

Whatever you look for in a bearing unit — quality — performance — economy — there's nothing comparable with SEALMASTER!

WRITE FOR CATALOG 454.

SEALMASTER® BALL BEARING UNITS

SEALMASTER BEARINGS

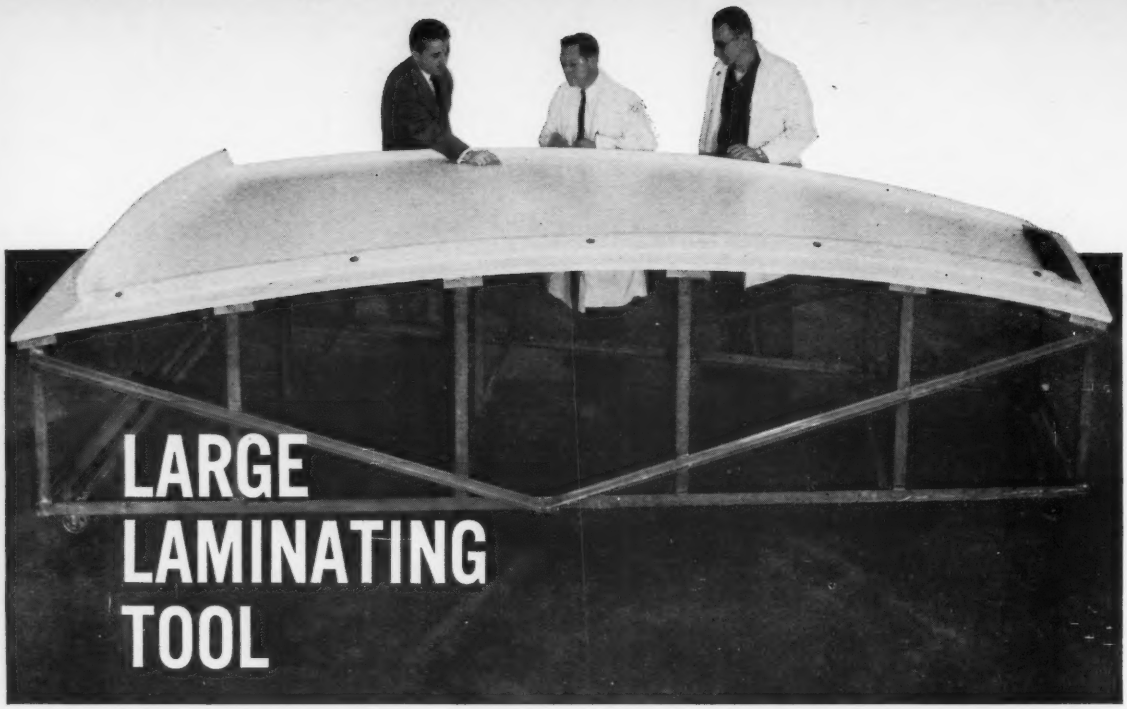
A DIVISION OF

STEPHENS-ADAMSON MFG. CO. OF CANADA LIMITED,

BELLEVILLE, ONTARIO

S291C

For further information mark No. 143 on Readers' Service Card



This Laminated BAKELITE Epoxy Resin-Glass Fibre Tool is used to shape sectors of a convex epoxy-glass part, each measuring about 14 by 6 feet.

MADE AT 80% SAVINGS

using BAKELITE epoxy resin-glass cloth laminate

You gain two distinct advantages when tools are made with BAKELITE epoxy resins. Tools can be produced rapidly, and they result in substantial savings in cost.

Tool makers and buyers have dramatically proven the merits of epoxy laminate tooling. In one case, a parabolic shaped laminating tool – approximately 15 feet long and seven feet across – *was made and placed in production in a minimum amount of time.* In addition, it has a smooth and flawless surface, producing parts with no detectable distortion. It is claimed that this epoxy-glass tool saved approximately four-fifths of the estimated cost of a laminating tool made from other materials.

If you are concerned about your present tooling expenses, investigate epoxy resin-glass fibre combinations. For further information write to Union Carbide Canada Limited, Bakelite Division, 123 Eglinton Ave. E., Toronto 12, Ontario.

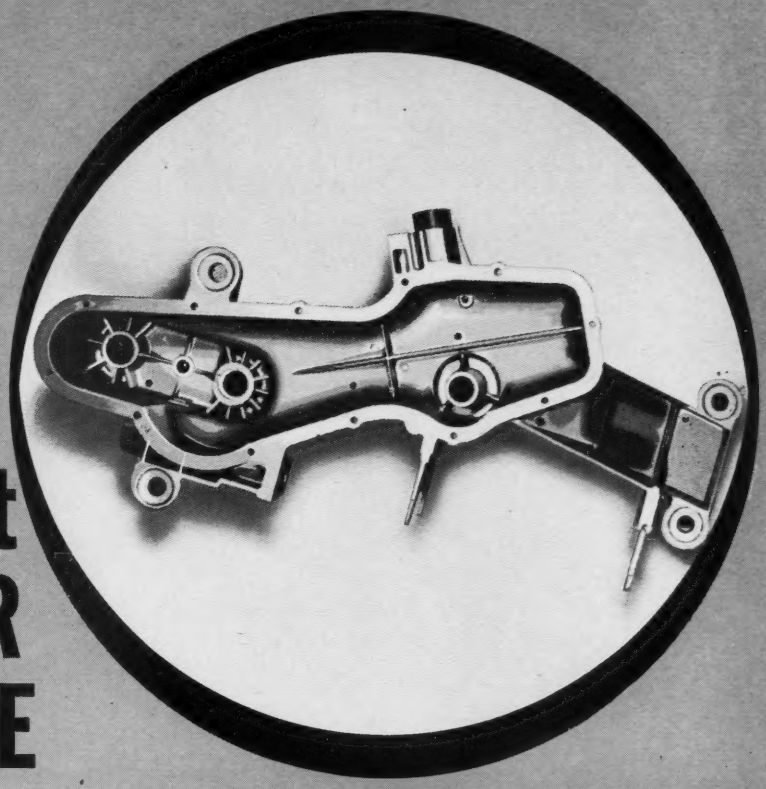
UNION CARBIDE

BAKELITE DIVISION

"Bakelite" and "Union Carbide" are registered trade marks.

For further information mark No. 106 on Readers' Service Card

ZINC made this Low-Cost ANSWER POSSIBLE



The Problem: To produce this complex washing machine part as efficiently as possible.

The Answer: Zinc die casting.

The design of this part as a zinc die casting was simplified by the versatility of the metal. Die cast design in zinc can safely include thin sections and still maintain a high strength-to-weight ratio. Section thicknesses may be varied in the same casting. Because of zinc's dimensional stability, complex shapes can be easily and consistently mated. These factors plus zinc's smooth "as cast" finish and innate, corrosion-resistant characteristics make parts, die cast from this metal, suitable for a very wide range of uses.

Zinc saves money in die cast production because no other metal costs as little or permits such efficient operation of equipment.

Zinc die casting is an effective answer to complex design problems.

DIE CAST WITH **ZINC** *FOR EFFICIENCY AND ECONOMY*

COMINCO

THE CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA LIMITED, MONTREAL

For further information mark No. 115 on Readers' Service Card

There's no end of possibilities with

STEEL TUBING
by STANDARD TUBE

STANDARD TUBE
STANDS FOR
ALUMINUM TOO!
Sheet, Bar, Extrusions,
Tube and Wire—avail-
able in any quantity.

STANDARD TUBE AND T.I. LIMITED

WOODSTOCK - HAMILTON - TORONTO - OTTAWA - MONTREAL - VANCOUVER

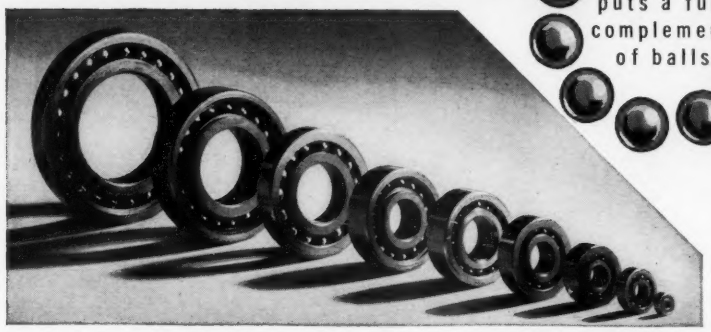
AGENTS IN OTHER PRINCIPAL CITIES

For further information mark No. 141 on Readers' Service Card

A New Concept in design . . .

A Wider Scope of Application Possibilities

HEIM BALL BEARINGS



HEIM puts a full complement of balls around a solid inner raceway with deep, burnished ball grooves

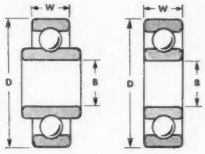
and fits a solid outer, grooved raceway around the row of balls to make a bearing with fewer parts to give longer life at increased radial and thrust load capacities.

From the miniature series, (.1250 o.d.) to the "H" series, (2.4409 o.d.) there are bearings with inch as well as metric dimensions, extremely narrow widths, small diameters, double row types, plain or flanged outer members, and a wide variety of special designs.

MINIATURE SERIES

DIMENSIONS:
O.D. (D) .1250 to .3750
Bore (B) .0400 to .2500
Width (W) .0469 to .1250

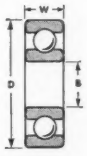
This miniature can be supplied with extended inner races.



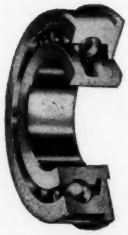
Materials can be 440 S.S., high carbon chrome or others. Also made with single or double shields.

R SERIES

DIMENSIONS:
O.D. (D) ½" to 2"
Bore (B) 3/16" to 1"
Width (W) 5/32" to ½"

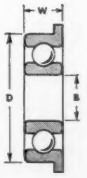


RF SERIES



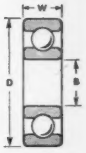
DIMENSIONS:
O.D. (D) 5/8" to 2"
Bore (B) 3/16" to 1"
Width (W) 3/16" to ½"

Raceways are deep carburized and hardened. Close, integral labyrinth seals may be had on one or both sides.



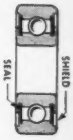
Send for catalog.

H SERIES



DIMENSIONS:
O.D. (D) 1.1811 to 2.4409
Bore (B) .3937 to 1.1811
Width (W) .3543 to .6299

These bearings can be furnished with single or double shields, or with shields and seals.



The Heim method of bearing manufacture adapts readily to the production of special forms for bearings where volume warrants.

The outer ring of this bearing is 2.1250 o.d., has the gear teeth cut to specifications, is completely sealed on both sides, and ready for assembly into finished product.

Grooved on the outside to act as pulleys or rail guides, these bearings have all the advantages of strength and simplicity of the Heim design, plus the reduced cost of manufacture.

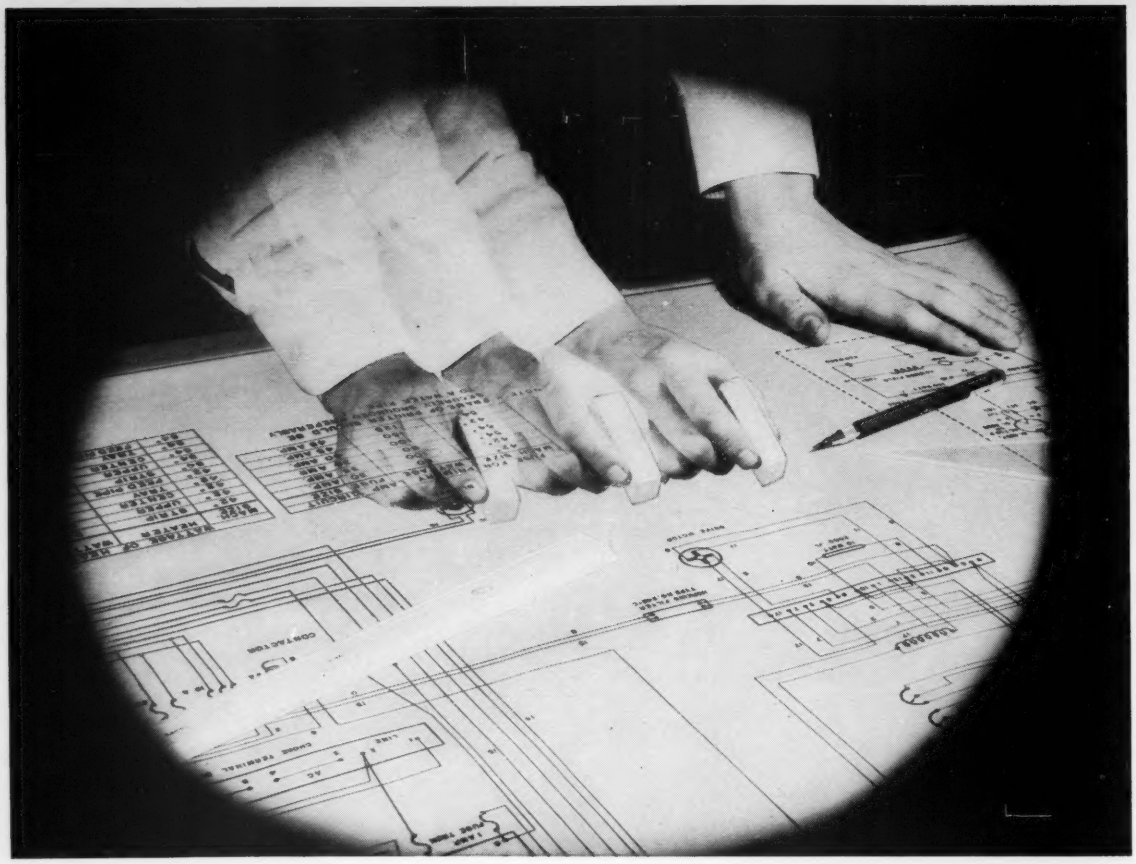
For standard ball bearing sizes, see your bearings distributor. For special designs or applications, write or call for engineering assistance.

R&M BEARINGS CANADA LTD.

QUEBEC CITY	MONTREAL	WINNIPEG	THREE RIVERS	TORONTO	VANCOUVER	LONDON, ONT.	HAMILTON	SEPT-ILES, QUE.
755 Blvd. des Capucins	1006 Mountain St	1302 Notre Dame Ave.	375 St Georges St	338.50 Edward St	1066 Seymour St.	1024 Oxford St. East	130 Ferguson Ave. N.	385 Joliette St.

FACTORY REPRESENTATIVES AND DISTRIBUTORS FOR CANADA

For further information mark No. 127 on Readers' Service Card



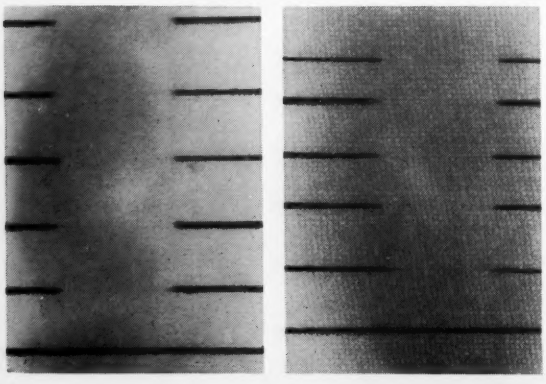
Make this erasure test and see for yourself why . . .

CRONAFLEX* HAS THE BEST DRAFTING SURFACE YOU CAN USE!

A good example of the consistent, balanced surface of CRONAFLEX is its superior *erasability*. CRONAFLEX not only erases easily and cleanly; it takes repeated erasing without ghosting or surface damage.

To prove it, make this simple test: draw a series of 6 lines horizontally on CRONAFLEX. Erase a vertical path through each line as you draw it, with a stroke long enough so that each succeeding line is drawn through another erasure. Now make the same test on the best grade of pencil cloth you have and compare the results. For more proof, reproduce each sample in a diazo machine and compare the prints.

Notice how cleanly and evenly CRONAFLEX (left) erases, without smudging or ghosting. Notice density and consistency of bottom line, drawn through 5 erasures! Compare same test made with good grade of pencil cloth (right). Bottom line drawn through erasure path is not uniform; erasures are uneven.



Superior covering power, cleanness of erasures and consistent line density—despite repeated erasing—are just a few of the reasons why CRONAFLEX gives you the best drafting surface you can use. For others, contact your local Du Pont Technical Representative or call your local Du Pont Photo Products Sales Office listed below. Du Pont of Canada, Limited, 85 Eglinton Avenue East, Toronto 12, Ontario.

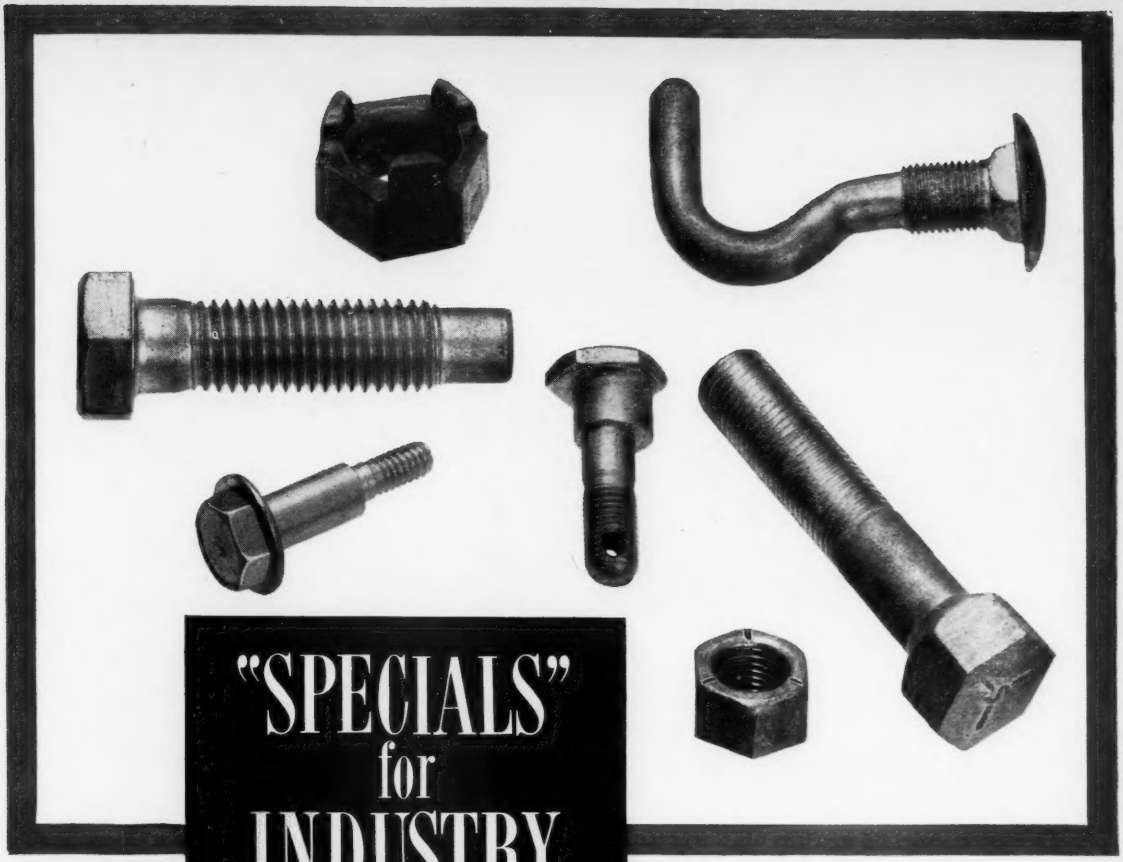
DU PONT
CANADA

Better Things for Better Living . . . *through Chemistry*

Montreal	Box 660
Toronto	85 Eglinton Avenue East
Winnipeg	428 Portage Avenue
Calgary	1011 — 17th Avenue, S.W.
Vancouver	1687 West Broadway

*Registered trademarks of E.I. du Pont de Nemours & Co. (Inc.)

For further information mark No. 124 on Readers' Service Card



"SPECIALS" for INDUSTRY

• *Produced economically to customer requirements!*

STELCO COLD HEADING

Five of the pieces shown above are produced by cold heading plus additional secondary operations.

Starting with wire of any forgeable metal up to 1" in diameter, Stelco can upset it to at least 4½ times its original diameter to produce contoured components for industry.

Cost reductions of 40% and higher are not unusual when a part is produced by cold heading or hot forming, with secondary operations where necessary, rather than by machining. This saving is realized because material scrap loss is avoided and production rates are increased.

Frequently "special" fastener requirements can be met by simple design changes or additional operations to standard items already in normal production, and Stelco will carry long run "repetitive specials" in stock to provide a ready source of supply.

Consult Stelco's Engineers on the production and design of "Special" Fasteners or parts to your own requirements. Sales Offices are established from coast to coast to serve you.

STELCO

THE STEEL COMPANY OF CANADA, LIMITED

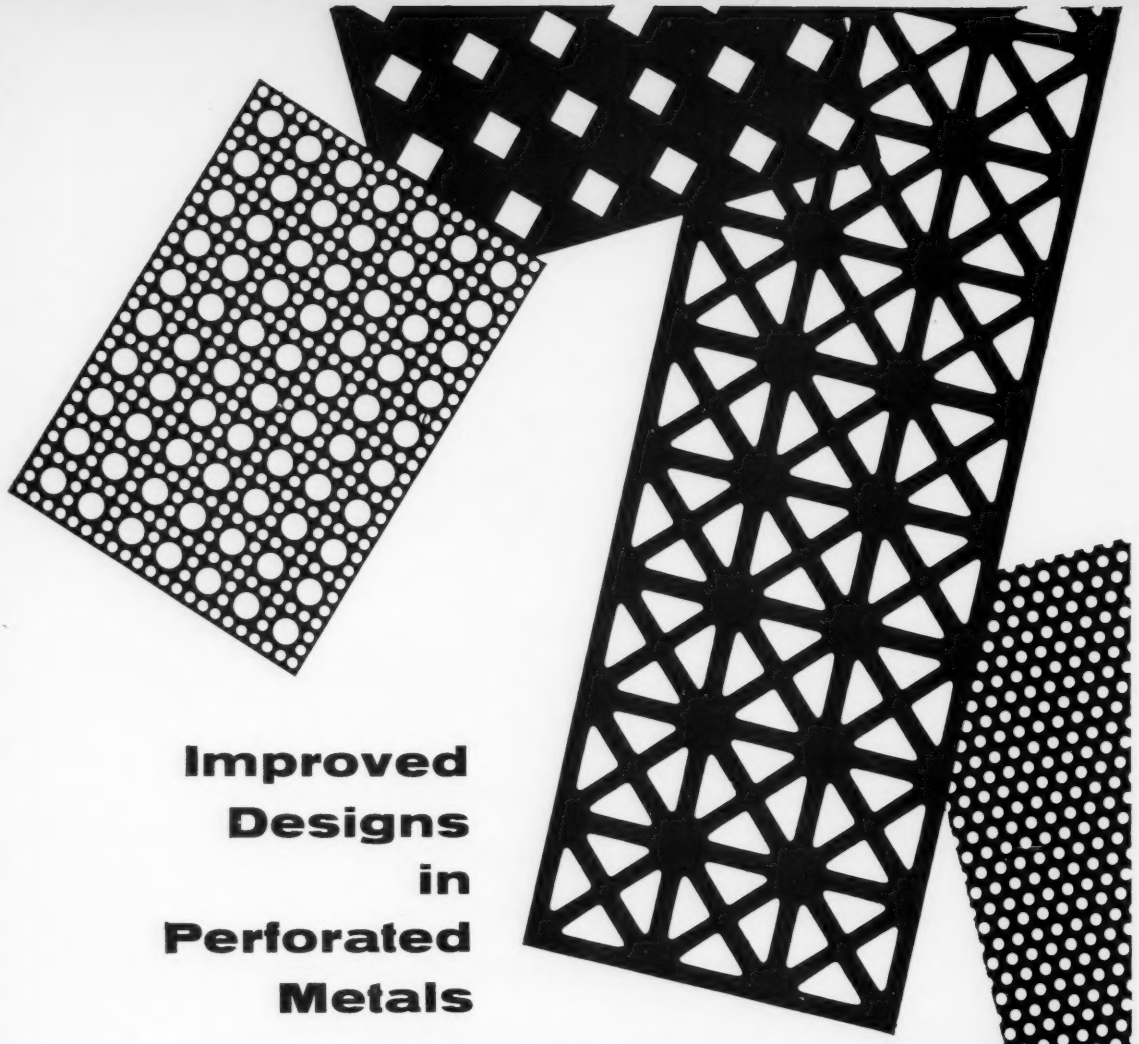
Executive Offices: Hamilton and Montreal

Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Winnipeg, Edmonton, Vancouver. J. C. Pratt & Co. Limited, St. John's, Newfoundland.

BUY CANADIAN

59192.B

For further information mark No. 142 on Readers' Service Card



Improved Designs in Perforated Metals

for contemporary decoration and utility

Great visual charm and improved function result from the tasteful use of contemporary perforated metals. Growing design opportunities in architectural applications and in accessories stem from improved techniques in perforating, and of course new demand stimulates greater research in metal perforating.

A constantly expanding line of patterns is at your disposal, here at Donald, in a host of materials . . . in all metals, alloys, plastic, rubber, 'most anything. Our Technical Department would be pleased to collaborate with you.

Please write for our brochure on Perforated Metals.

DONALD
ROPES & WIRE CLOTH LIMITED
HAMILTON • CANADA

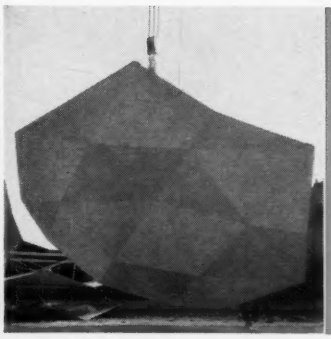
Other offices and warehouses in Montreal, Winnipeg and Regina. Field representatives all across Canada.

D-79

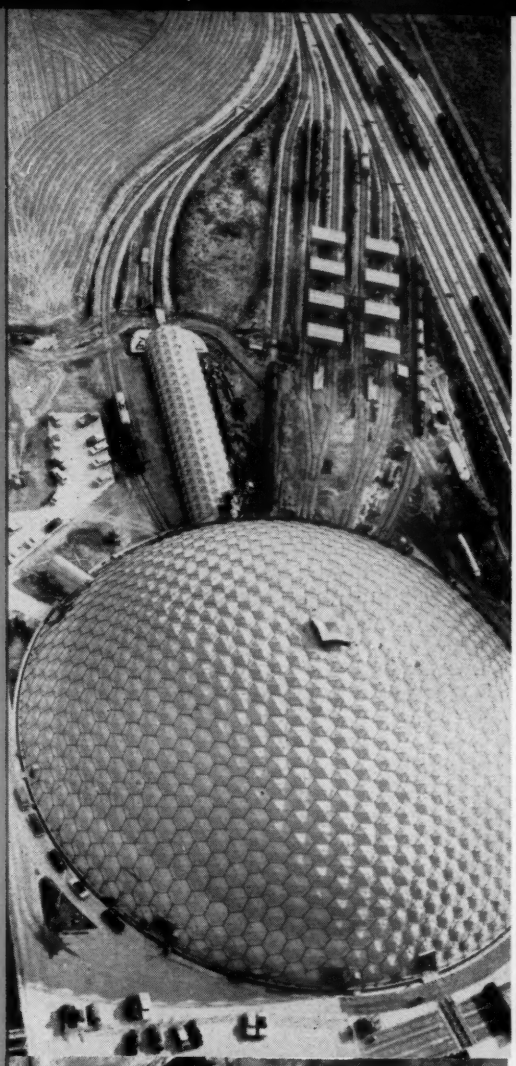
For further information mark No. 121 on Readers' Service Card

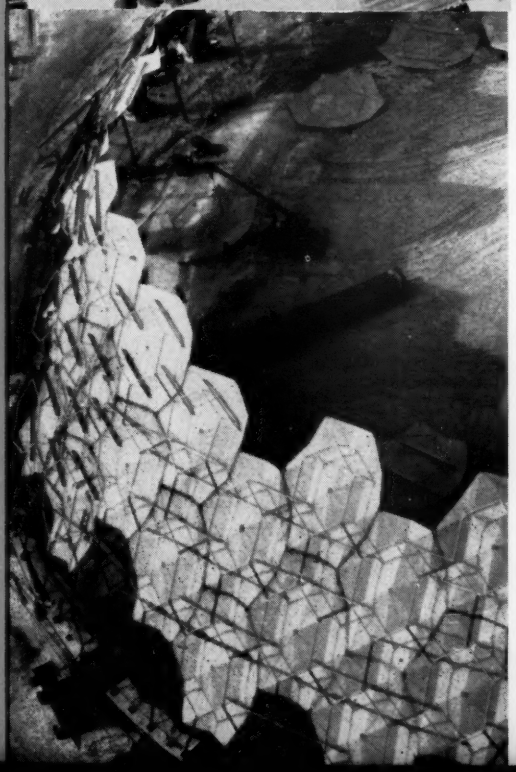
Design Engineering
June, 1961

Geodesic domes can reshape Canada's north



Constructed section by section, Union Tank Car Company's repair facility at Baton Rouge, La., is the world's largest circular building. Diameter across its base is 384 feet.





Engineers are finding practical uses for a structure that could make life more pleasant in any climate

A structure as simple as the Eskimo's igloo may be a factor in making Canada's far north more habitable. It is the geodesic dome, a building capable of covering an entire community and creating an artificial climate where vegetation would flourish and people could go about their work and pleasure in shirtsleeves despite the cold outside.

A federal civil servant who toured northern outposts had this to say:

"We talk about northern development, but what sort of people do we get? People thinking only of making money and getting out."

The geodesic dome might prove to be the answer

to the problem of permanent settlement in the Arctic areas.

These domes are not something years away. They are here today. For example, a dome 1400 ft in diameter is being designed in the United States by Graver Tank and Manufacturing Company. It would house a race track, a baseball diamond, a football field and other sports facilities. No ball game would be rained out there.

Aeronautical officials are considering free-span geodesic domes for airports and college presidents envision it covering their campuses. The structure need not be circular, it can be other spherical shapes.

Sparling Tank & Manufacturing Company (a division of Products Tank Line of Canada, Ltd.) has arranged with Graver Tank for its full design facilities in carrying out geodesic dome construction projects in Canada.

"Geodesic" is a derivative of the word "geodesy", that branch of mathematics which determines the exact positions of points on the earth's surface. Work in geodesics involves spherical surfaces.

Geodesic principle is patented

Calvin G. Miller of Graver Tank & Mfg. Co., recently gave the Engineering Institute of Canada (Toronto branch) a talk on the background of geodesic domes.

"The principle was discovered by R. Buckminster Fuller, a mathematician, designer, and advanced thinker. I use the word 'discover' advisedly, because geodesy, like all engineering principles, existed from the time natural forces came into existence, and therefore could not have been invented. It is the job of the engineer and scientist to determine only how nature's forces, which are in existence, will behave. Mr. Fuller has followed the study of the principle for some 30 years and only comparatively recently has been able to patent his application of the principle."

He found that intersecting and interconnected stress members lying along great circles on a sphere are mutually supporting. That is, forces applied along the axis of one are transmitted to the others, thus the force applied to one is resisted by all the interconnected members. A structure built around this principle was found to have great strength and rigidity because forces applied at any point are distributed over the entire structure.

To apply this geodesic principle, Fuller found it necessary to organize the intersecting stress members in some way that would lend themselves to practical construction. To do so, he investigated all the regular configurations that could be inscribed inside a sphere to find the most advantageous pattern for the stress members; first the tetrahedron, with four sides, each an equilateral triangle; then the hexahedron or cube; the octahedron with eight sides, each an equilateral triangle; the dodecahedron, with 12 sides, each a regular pentagon; and the icosahedron with 20 sides, each an equilateral triangle. Of these the icosahedron lends itself best to his purpose, and he based his design upon it.

Icosahedron pattern is best

An icosahedron inscribed in a sphere is rigid and retains its shape without further bracing. The five sides adjacent to any one icosapoint form a five-sided regular pyramid known as an icosacap which are on the surface of the sphere with the sides forming chords. The portion of the sphere bounded by an icoscap is known as an icosadome which comprises one-fourth of the entire sphere.

Filling out the details, Miller went on to say:

"By connecting the icosapoints with great circle lines on the surface of the sphere, and on the icosadome, we form five equilateral spherical triangles. We bisect each of the great circle lines with another great circle line perpendicular to it. It divides each of the equilateral spherical triangles into six equal triangles. So far, we have 30 triangles bounded by 50 sides, and we have only three different lengths of side. By replacing the lines we now have with stress members forming chords of the sphere, we could construct a geodesic dome.

"Thus we have here a two-frequency dome. Such a low frequency dome would have more semblance to the icosacap than to a sphere and would not have the pleasing appearance that is desired. Furthermore, in a large dome, the lengths of the stress members would be beyond practical limits.

"Therefore, if we further subdivide the great circle line, always by cutting with another great circle line perpendicular to it, we form more triangles of smaller size. This process need only be continued until the desired practical length is obtained. In further subdividing, we do not get triangles all of the same shape, but we do get a high degree of repetition so that the different lengths of triangle sides stay within practical limits. In a 36 frequency dome, which has over 5400 triangles, there are only 36 different lengths of members and 36 different triangles. Obviously, if all triangles were different it would be a near-impossible task to compute the lengths of so many chords, and to fabricate so many different members. However, this phenomenon of repetition to members makes the solution entirely practical.

"Having determined the practical frequency to give stress members of convenient length, the members must then be designed to withstand the stresses resulting from the live and dead load that will be imposed, such as snow load, wind load, and other loads resulting from internal hangers or supports."

Design domes to meet needs

Domes can be designed in numerous ways depending on the requirements of the space and the loading conditions. In the dome built for Union Tank Car Company at Baton Rouge, for example, the stress members are above the skin in a honeycomb pattern and form the compression members of a truss about 48 inches deep. These members are made up of 4 in. diameter pipe and ¾ in. and 1½ in. diameter rods. The skin of No. 11 gauge steel forms the lower or tension members of the truss. This is known as a stressed-skin design.

A similar dome, built at Wood River, Illinois was of the stressed-skin design, but the stress members were in a triangular pattern rather than hexagonal, and the depth of the truss was cut in half. In this concept, the struts are fabricated from 6 in. light-gauge pipe while the steel skin is again No. 11 gauge. Both structures are 384 ft in diameter and 116 ft high.

Another design possibility puts all the stress in the compression members; such a structure is stable without any skin at all. In this design the skin is nothing more than a weatherproof membrane and would be applied after the primary structure is completed. The dihedral angle between adjacent stress members on a great circle line becomes extremely important in this concept because it governs the frequency that is used.

If the dihedral angle is too small, there is a tendency for the dome to involute or reverse the angle at certain points. To resist this tendency the individual stress members must be "beefed up", resulting in higher costs. On the other hand, a large dihedral angle requires long, unwieldy stress members—beyond practical limits. An economical compromise must be found between these two extremes.

Space frame for large structures

A third design has its application in the sizes larger than those that appear practical for the stressed-skin designs. It is called a space frame and resembles the stressed-skin design to the extent that it is a truss with compression members on top and tension members on the bottom. However, the lower members of the truss are of the same form as the top members and the two are joined by intermediate bracing. In this design, the skin is not a part of the structure, and the dome is stable without it.

The problems of erecting such structures are interesting. The skin of each of the domes in Baton Rouge and Wood River was fabricated in the form of hexagonal pyramids, comprising six of the triangles that were formed by subdividing the great circle lines. They average about 16 feet across and are approximately two feet high. The dome at Baton Rouge was built first, and was erected in the conventional manner by starting at the foundation and building up to the top. Each construction unit was a preassembled section consisting of one pyramid and one face of each of the six adjoining pyramids, with the corresponding compression members. No scaffolding was used other than planks across the stress members on the outside. All lifting was done with cranes without any derricks of any kind. All connections were made by electric shielded arc welding.

Erected on a balloon

When erection procedures were being worked out for the second dome, it was felt that fitting the sections together would be much easier if no stresses were present from dead load, and work could be performed at ground level. After considering several methods a pneumatic method was decided upon. This method means, in effect, construction on top of a balloon.

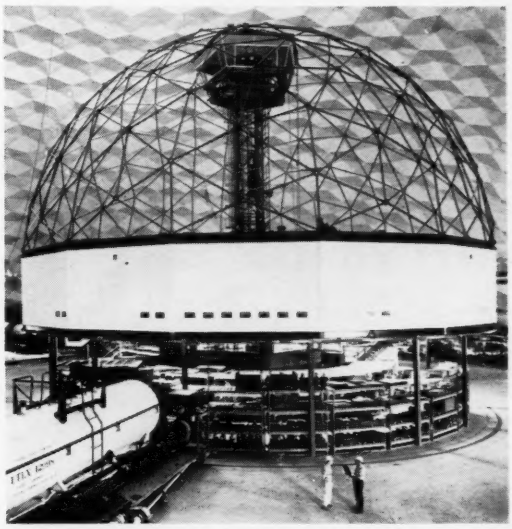
Erection started at the center on scaffolding 32 feet high and proceeded on the scaffold to a diameter of 200 feet. Then the weight was taken on jacks around the edge and the scaffolding was removed. At the 175 foot diameter point, a plasticized nylon curtain was attached to the underside of the dome for the entire circumference.

The curtain hung to the ground and extended on the ground for some distance toward the center. It was fabricated to the same spherical radius as the dome. Ropes connected the curtain to a point at the center. Previously, an underground tunnel five feet in diameter had been installed from the center to a point outside the foundation, where it connected to two 20,000 cfm blowers, each powered by a 25 hp electric motor.

The tunnel was also equipped with an air lock for personnel access, since there were no openings in the air curtain. We then, in effect, started "blowing up the balloon." Control was effected by a manually operated vent in the top of the dome. Air was introduced at a constant rate of 20,000 cfm. To raise the dome, the vent at the top was closed and the input of the blower caused the dome to rise, since the blower could develop 2.3 ounces per square inch pressure, and the weight of the dome was only approximately 1.6 ounces per square inch. At the proper height, the vent at the top was opened sufficiently to stop further movement.

Work then proceeded around the periphery of the dome at ground level. Then the operation was repeated. About 10% of the weight was taken on jacks outside the curtain to give the dome stability. As the dome raised higher and higher the curtain was allowed to slide along the ground outward from the center and conformed to the shape of the dome. Two balloons, one 8 ft in diameter and another 12 ft in diameter, were kept available inside to block the opening should a tear occur in the curtain. They were never used. Guy lines were used to resist wind pressure. This operation continued until the last sections of the dome were installed with the dome just about foundation level. It was then allowed to settle into place on the foundation. This dome, too, was all welded.

This method of erection was very successful on this particular size of dome. It might or might not be equally as good on other sizes. This could only be determined by a study of all the conditions for each particular job.

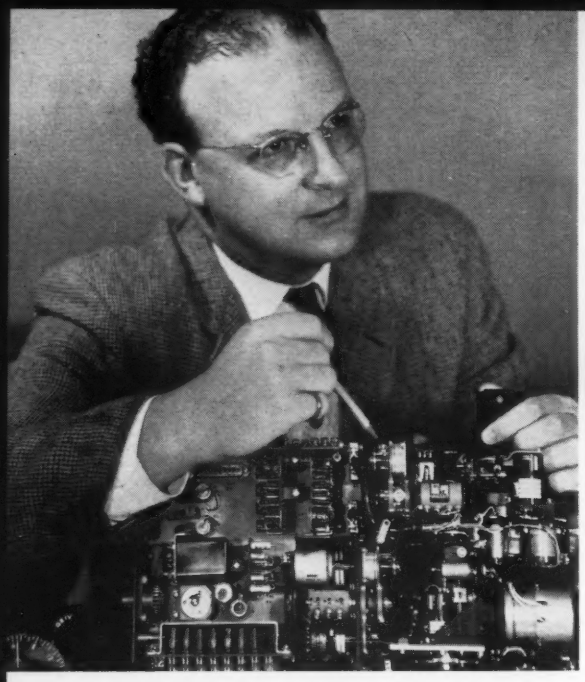


Tank car repairs at Baton Rouge are centred on a dome within a dome. This internal structure is as high as a 7-story building.

Mr. Miller went on to spell out further uses for the dome. "Once we re-orient our thinking in terms of curves and arcs from the angles and squares that we are accustomed to dealing with in conventional construction, we find that the dome lends itself admirably to many uses. The two domes that we have just described were built to house tank car repair shops."

The domes could be used for auditoriums, theatres, shopping centers, car agencies and community centers. Prospects for shopping centers were bright.

A design has been developed for a shopping center housed under a 525 ft diameter dome. Instead of the complex of buildings usually seen in a shopping center, food markets, department stores, shops, and a permanent exhibition area comprising two floors, would all be housed in this one building. In addition, parking for 2500 cars will be provided underground. ★



Project engineer E. K. Hammond and the computer which is the heart of the PHI, now being made for seven NATO countries as well as the RCAF. The entire three unit system weighs 24 lb.

E. T. Burch
Staff writer

A design profile

PHI in the sky — for a safe flight

The story of how Canada designed a new concept in aerial navigation

When you're thundering through the wild blue yonder in a modern jet aircraft, the chances are you have a fair amount on your mind. With your airspeed indicator clocking off upwards of 750 miles per hour, there's little time to enjoy the scenery. Flying at this speed, split-second navigation is essential. Your primary worry is not where you are at the moment—but how many minutes and seconds you can allow to elapse before you reach your destination—and what course to steer during those remaining seconds. Where in the sky you happen to be at the moment doesn't matter—it's where you're going to be during the busy few minutes ahead that forms the pin-point focus of all your attention.

Computing Devices of Canada started working on a solution to this problem back in 1951. The answer is a $15,000,000 feather in the cap of Canadian engineers, who designed a new concept of aerial navigation which has aroused the interest of air forces and commercial airlines the world over.

Faster than you think

Let's look at the following example: you take off for a target 250 miles away. Once you're airborne at a speed of 750 mph, you have twenty minutes before you reach your destination. During the flight, which may involve a requirement for complete freedom to manoeuvre, the position of your target or destination must be continuously available in relation to your aircraft so you can locate and reach this objective within the limits of your available fuel. The problem of continuously establishing your position in relation to either the target or the takeoff point by normal means involving computations using speed, direction, wind and time is a full-time job for a navigator. But there isn't any room for a full-time navigator in modern jet fighters. Thus the development of automatic dead-reckoning navigation equipment has been an essential factor in the evolution of effective high-speed modern aircraft.

PHI is the answer

The Position and Homing Indicator (current model is PHI Mark 5) is a lightweight precision electro-mechanical system consisting of a computor, a wind measuring unit and a pilot's indicator. The system accepts inputs of information provided by air data, doppler or inertial sensors and computes and displays to the pilot the position of the aircraft relative to the target or destination in terms of range or bearing.

In layman's language, the PHI computes, remembers, and states exactly where the plane is at any moment during its flight in relation to its target. No matter how the pilot twists, turns, or changes speed, the

PHI continuously provides him with compass course and distance to any one of twelve selectable targets or destinations.

Before takeoff, the pilot inserts a simple station selector package containing the co-ordinate memory data for up to twelve preselected destinations. During the entire flight, the pilot has all the navigation information he needs at his fingertips—he simply has to select the station he wants—as easily as changing channels on a television set — and the PHI provides him instantly with the course to fly and the distance to this destination.

Weighs only 12 pounds

The PHI, which weighs 24 pounds, is contained in three boxes small enough to be a minor factor even in today's crowded cockpits. Only one of the boxes, in fact, is located in the cockpit—the others are remotely installed. Now built for seven NATO countries in addition to the RCAF's CF-104 Starfighters, the value of current and expected orders exceeds $15,000,000.

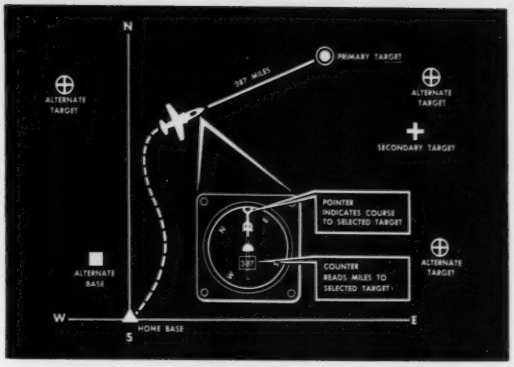
Fully transistorized, the system operates on less than 100 watts of power from the 400 cycle ac and 28 volts dc power supplies. In its dead-reckoning mode of operation, the system is completely independent of outside data sources such as radio and radar and is therefore free of jamming.

Computing Devices of Canada, which started operations in the fall of 1948, built one of the first fully automatic dead-reckoning navigating instruments for aircraft ever developed in Canada. During the war, several versions of a navigational instrument called the Air Position Indicator has been introduced, and proved of immense value to hard-pressed bomber navigators. But all were somewhat cumbersome in presenting information to the pilot. Following the war, further development of automatic air position indicators was dropped in favor of the seemingly more fruitful location techniques using ground aids, radio and radar.

Automation was required

As aircraft speeds increased, the need for some sort of automatic navigational computer became more and more apparent. The newly formed company decided to build an automatic dead-reckoning navigation system for a single-seat military aircraft which would incorporate allowance for wind direction and velocity. Concurrently, CDC decided to design and build a radically new True Air Speed Indicator. Both proposals were accepted by the RCAF in August, 1951. In temporary quarters in an old Ottawa store, the newly assembled design staff of CDC set out to develop prototypes.

The fledgling company made up in experience and enthusiasm what it lacked in tangible resources. The prototype of the PHI worked with an accuracy that far surpassed the designers' expectations. In wind tunnel tests, the True Airspeed Indicator showed almost complete precision, and since this was the key instrument on which the entire system depended, initial hopes were high. But in tests under actual flying conditions, everything worked to perfection until the weather turned bad; then the True Airspeed Indicator was found to be extremely susceptible to icing. Redesigning the unit to overcome this handicap presented many difficulties, so the PHI was adapted to use purely analog techniques to work with conventional true airspeed systems. The result was the PHI Mark 2A. This change carried an initial weight penalty of nearly double the original 15 pounds.



The indicator gives the pilot continuous and accurate information on course and distance.

The PHI Mark 2A was sent to the Wright Air Development Centre for testing by the USAF, and CDC temporarily turned its attention to another important development—an elaborate navigational system required by the RCAF for maritime reconnaissance aircraft. The system, known as ANTAC, was a much more elaborate project than the PHI, requiring 45 separate units, more than half of which were designed and developed by CDC.

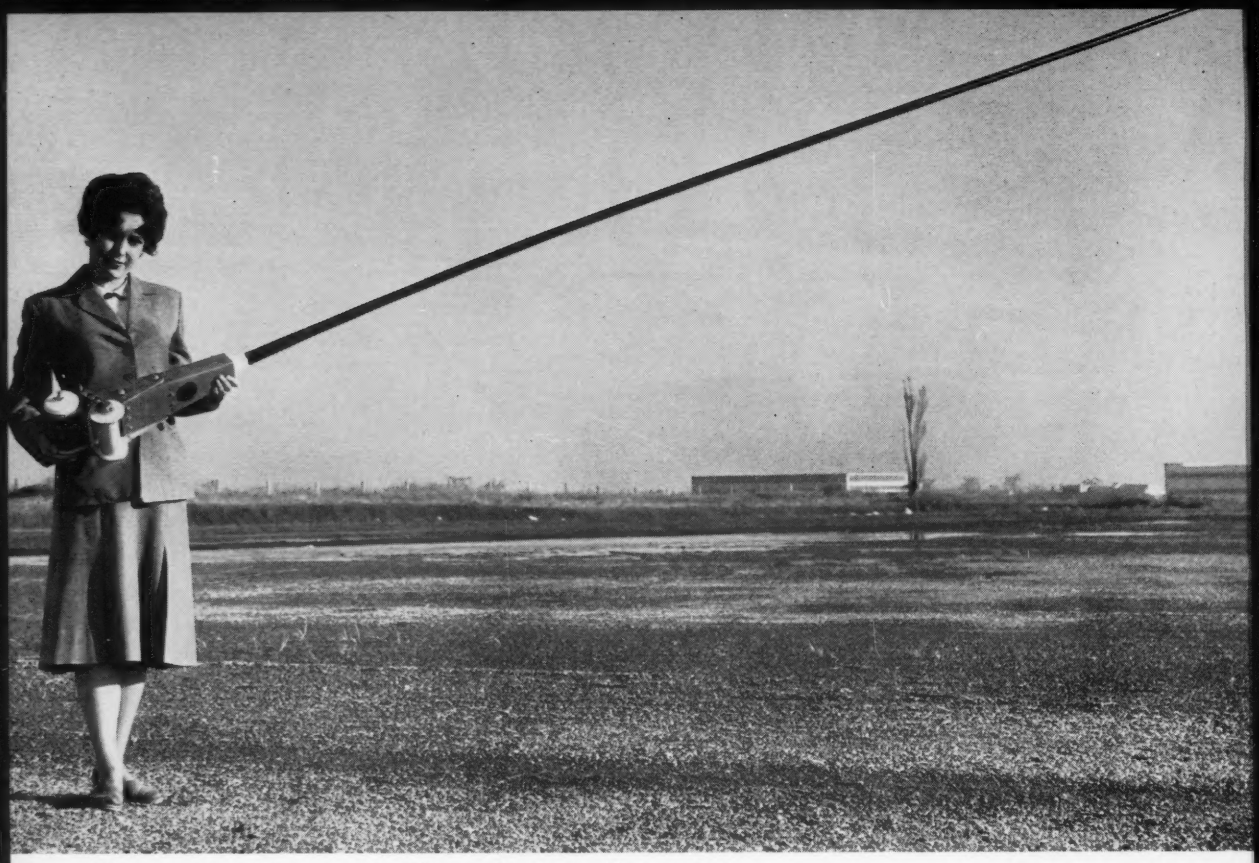
Design approved by air force

Suggested changes by both the RCAF and the USAF in the PHI led to the development of the Mark 2B, and a number were ordered for evaluation by the RCAF.

Design and development work continued, leading to the Mark 3, in which the presentation of information to the pilot was simplified to a range and bearing display, instead of the harder-to-read original grid display. Weight of the complete system was reduced to 25 pounds. Also incorporated were small transistorized servo amplifiers of CDC design. The Mark 4 followed, with several improvements permitting the use of the system with inertial sensors, followed by the present Mark 5. At present, the Mark 3B, 4 and 5 systems are in full production at the CDC plant, as well as at several licensed plants in Europe.

CDC is presently awaiting evaluation of a commercial aircraft navigation system known as "Skyline." Actual hardware to meet the stringent requirements of intercontinental airlines came into existence early in 1957, when Skyline was demonstrated at a meeting of airline representatives in March of that year. It wasn't a polished product. Assembled from modified PHI components for demonstration purposes, it had only one major virtue—it worked with amazing accuracy. Airline officials found fault with the presentation system—the mounting arrangements—the size and shape of the instruments. But they were impressed with its possibilities, and said so. Being independent of ground aids, Skyline is applicable on any transocean or transcontinental route in the world, including the polar routes which are proving to be an important short-cut between major centres in Europe, Asia and North America.

Its future looks impressive—sales are being handled by The Bendix Corporation. Skyline will soon be flying with the world's major airlines: still another feather in the cap of Canadian design engineers. ★



The antenna partially extended. When satellite is in orbit it would be fully extended for probing the upper ionosphere.

Space-age antenna: a Canadian first

Canada revives an antenna design to solve a depth-sounding problem in space

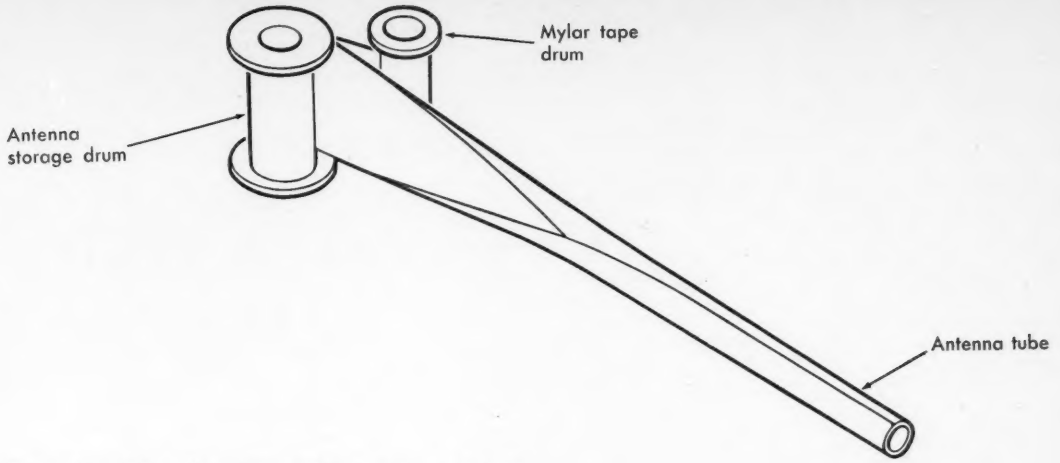
When Canada's first satellite goes into orbit, probably early next year, it will assume the role of a top-side sounder, doing in the ionosphere what the echo sounder does in the ocean depths. The most important components for performing this task will be two pair of long retractable antennae which were designed by Canadians almost ten years ago and shelved for want of a suitable job. Now they have suddenly had fame thrust upon them, and show promise of an even more spectacular future.

Basic design for the antennae was developed by George Klein and his staff at Canada's National Research Council for use in air-dropped automatic transmitting equipment. When plans materialized for the Canadian satellite probe into the ionosphere, Defense Research Board saw the antennae as the right tools for the job and lifted the blueprints from their dusty files to have them modified by the Special Products Division of de Havilland Aircraft of Canada.

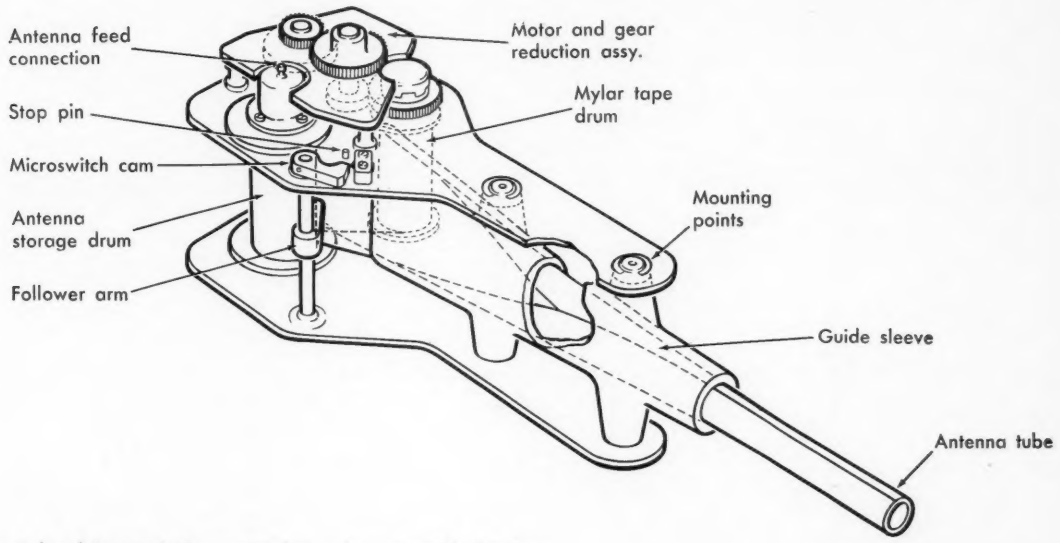
For the satellite program de Havilland came up with two pair of the antennae, 75 and 37½ feet long respectively. At launching and during flight they are coiled inside their shell and are extended to full length by an electric motor, once the satellite is in orbit. The antenna element is a roll of spring steel or beryllium copper material on a storage drum. This is fed through a plastic guide sleeve supporting the material as it changes from a flat cross section into its natural tubular shape. Fully extended, the two edges of the antenna tape overlap 180 degrees, giving the tube almost the same strength as a seamless tube of the same diameter and wall thickness. A thin mylar tape interwound with the guide sleeve is reeled on to its own drum, rapidly pulling the antenna material through the sleeve.

An unravel restraint feature checks any possibility of the material's paying off the storage drum from vibration during launching. When the antenna is fully extended a hole in the drum is exposed permitting a spring-loaded follower arm to drop into position. This activates a cam which closes a micro-switch, cutting off power supply to the drive motor.

Each antenna unit is a self-contained package with its own power supply, automatic power cut-off and



Formation of the tube antenna relies on a simple principle using a roll of spring steel or copper beryllium.



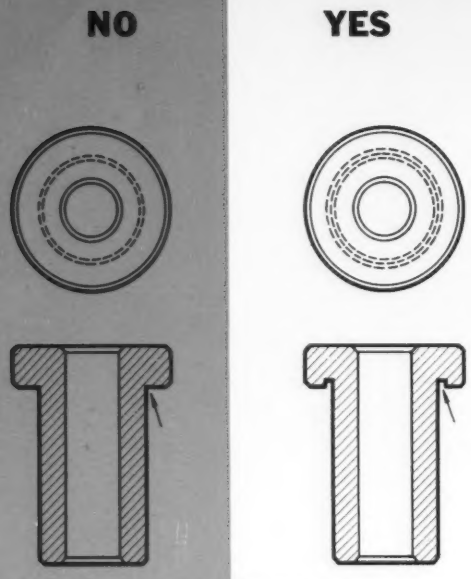
A breakdown of the mechanism unit responsible for formation and erection of the antenna tube.

manual rewind for ground testing. Because of the modular design a variety of mounting arrangements is possible.

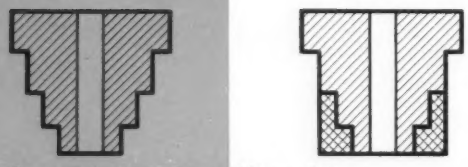
The antennae will be tested sometime this year in a Javelin rocket nose cone to be fired by the U.S. National Aeronautical and Space Administration from Wallops Island, Virginia. Climbing vertically the rocket will soar to 600 miles. When it reaches the outer fringes of the atmosphere the nose cone will be sprung off and the antennae tested in a much more rugged environment than will be experienced in the Canadian satellite.

Although the satellite application requires a fixed antenna length, the unit can be re-designed for other lengths. Adaptations are envisiaged for extendable booms supporting scientific experiments on magnetometers, ion gauges and particle counters. Possible ground antenna use is being considered, apart from the countless space applications. One modification has already successfully orbited the earth in a U.S. Lofti satellite which only recently re-entered the atmosphere.

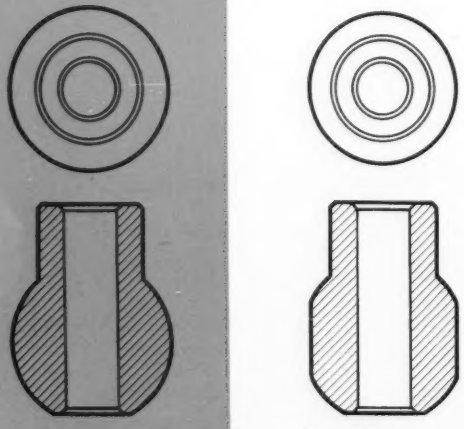
On the Canadian satellite the antennae will transmit sweeping frequencies between 2 and 11 megacycles into the very upper layers of the ionosphere. So far no-one has been able to probe these layers with high frequencies from earth, and this is the reason Canada's satellite has been ordered into space to do some vital investigation work. ★



All right angles require fillet or radius. When fillet cannot be tolerated undercut can be molded, as at right.



Strength is reduced in molding at left. Mold, as at right, then machine off the checkered section.



Ball-shaped parts or spheres can be molded, but a flat spot must be incorporated to prevent molding punches from contacting.

Powder metals increase profits

Follow the right steps with

Walter Irwin, P.Eng., of Metal

Atomizing and Processing Corporation

Can it be molded? How much does it cost?

These questions about powder metallurgy are receiving the attention of an increasing number of designers in this day of mounting emphasis on costs in relation to performance characteristics. Fanning interest are dramatic new applications for powdered-metal parts in the atomic and space age.

The answers to questions of moldability and cost involve a knowledge of powder metallurgy which, despite a lengthy history of parts made successfully from it, has been restricted in broader applications. This reflects a tendency of designers to call for more rigid powdered-metal specifications than a component actually needs.

Powder metallurgy is a rapid-fire, mass-production process in which the final consideration is usually the production of enough parts to warrant the cost of tooling, although some parts cannot be made by any other process. Overspecification adds to this capital outlay, as well as to high operational charges for inspection and quality control. Additionally it calls for more costly powders. These already cost more than basic metals because they have been improved by processing into powders.

An ancient art revived

Known in essence by the ancient Egyptians and the Incas, powder metallurgy lay dormant until the early 19th century when it had a brief splurge. Then it was pushed into the background by the speed of the industrial revolution. It re-emerged in 1916 to produce tungsten wire commercially and commenced in 1932 to win the serious attention of designers through production of porous (so-called oil-less) bronze bearings. This set the stage for the upsurge of the small-motor, fan and air-conditioning industries. Concurrently it sparked the development of ways of achieving 100% density in the naturally porous powdered-metal parts.

Turning out products known as sinterings, pressings or compacts, powder metallurgy requires the:

- Molding of metal parts from fine metal powders compressed to compact shape in a die.
- Sintering of the green compacts in a furnace to bond the adjoining metal parts.

▸ Repressing of the sintered compact in a second die to correct distortion as a result of sintering.

Many variants enter into cost, and quality control is highly specialized. No hard and fast rules can be laid down for economic production but minimum volume is usually of the order of 10,000 pieces.

There are five broad classifications in which metal powders are used industrially.

1. Parts made of two or more metals incapable of mixing by traditional methods. These may be alloys, or may retain the characteristics of each material.
2. Combining metals with nonmetals. These mixes are known as cermets—ceramics plus metals—and include tungsten carbide used in machining tools.
3. Preparation of refractory metals. Molybdenum alloys popular in jet propulsion must be produced by powder metallurgy.
4. Fabrication of special products, for example, oil-impregnated bearings of controlled porosity, and corrosion-resistant porous filters.
5. As a substitute for other processes because of design possibilities and elimination or reduction of secondary machining operations.

Design parameters

Size—Is governed by capacity of the press available, and the die block it can handle. Compacting pressures range from 15 to 50 tons pressure psi of projected areas, limiting the area within range of highspeed production presses to 4 or 5 sq in. Ratio of fill to finished part averages about 3:1.

Shapes—Pressure through the powder does not produce a lateral flow as with a liquid, and must be applied directly to the entire cross section. This limits the possible length of the part, as does also press design. Length should relate to wall thickness with a minimum of 0.32 in. up to 1 in. length.

Powder metallurgy is best suited to:

Cross-section dimensions with only slight variations.

Surface indents, top or bottom projections.

Flanges and projections, simple and at one end only.

Splines, gear teeth, knurling.

Holes, Counterbores, slots and keyways.

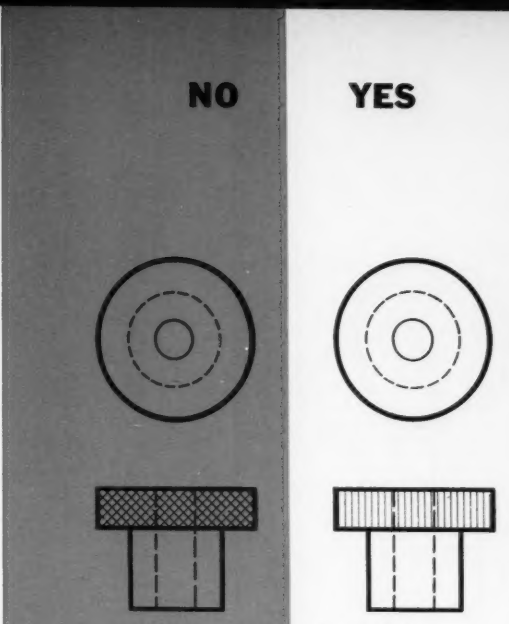
Undercuts and parts with re-entrant angles cannot be made. Parts with multiple steps must be made on complicated dies.

Machinability — Although compacting, sintering and sizing will usually be the only major operations required to produce a finished part, some designs will call for threading, undercutting, angle holes, etc. This can be done on traditional machineshop equipment. Since ordinary high carbon-steel tools dull rapidly with powdered-metal parts, tungsten carbide-tipped tools are required. Besides retaining their sharpness, these produce excellent machine surfaces, and actually improve the porous features of sintered bearings whereas a dull tool tends to smear and to impair porosity.

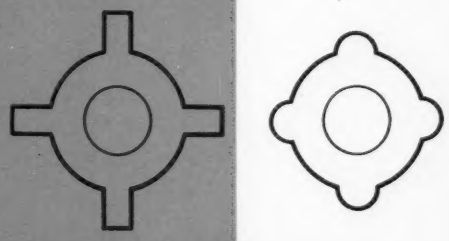
Porosity or density of a powdered-metal part is a major consideration. Low density can reduce tensile strength to only 25% of maximum realizable. While powders vary in hardness, particle shape and flow, density is more influenced by the amount and methods of applying pressure in the die, and die friction. Higher pressures increase density, but involve larger presses, accelerate die wear and tool breakage.

The porosity of a powdered-metal part can be controlled and usually runs from 15% to 35% by volume. There are four broad classifications:

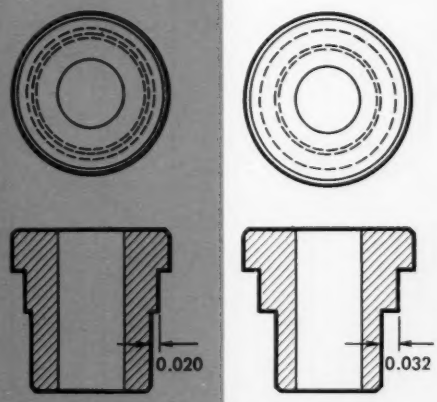
1. Densities of the order of 50% in filters and like applications.



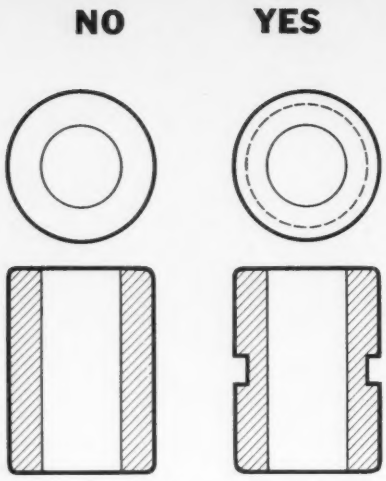
Diamond-patterned knurls cannot be molded but straight serrations can be.



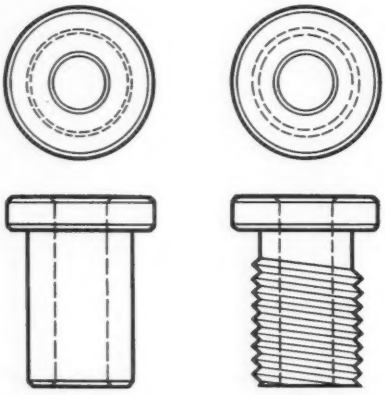
Flutes narrow in relation to depth should be avoided because of the difficulty in constructing and maintaining dies.



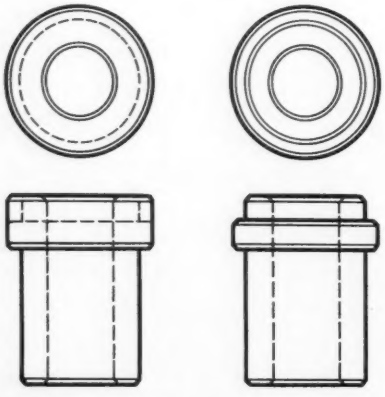
Parts with multiple steps can be molded if the steps are over .032 in. Wall sections under this increase tool maintenance costs.



Holes at right angles, and external grooves cannot be molded but can be easily machined in secondary operations.



Threads cannot be molded but powder metal parts are readily adaptable to machining.



For flanges, it is advisable to mold as at left, then machine to produce the flange shown at right.

2. Of the order of 75% in self-lubricated bearings.

3. Ranging from 80% to 95%, for structural applications.

4. Practical full density as a result of infiltration of the pores with metals of a lower melting point.

The size of the pores can be varied to control the rate of flow of liquids through it without affecting the percentage of porosity.

Welding—Powdered-metal parts can be welded just like cast metals.

Peening—Powdered-metal parts can be so handled as to be malleable enough for peening, riveting and swaging.

Soldering—Is practical for nonferrous metal parts, but cleanliness is emphasized.

Brazing—This is practical although distortion occurs as a result of high temperatures.

Finish—Parts subject to wear can be case hardened. A satin finish can be obtained by tumbling. Powdered-metal parts take paint, lacquer and enamel but porosity poses problems in degreasing and painting. Plating is successful although repeated rinsing and drying are necessary to remove all the plating solution. The plating operation decreases porosity, improves surface texture but does not close the pores.

Powder metallurgy is one of several metalworking processes which required 20th century mass markets for manufactured goods before it became economic. More than 100 fabricators in Western Europe and the USA are now making sintered compacts, and at least three in Canada. Many more are looking at the process.

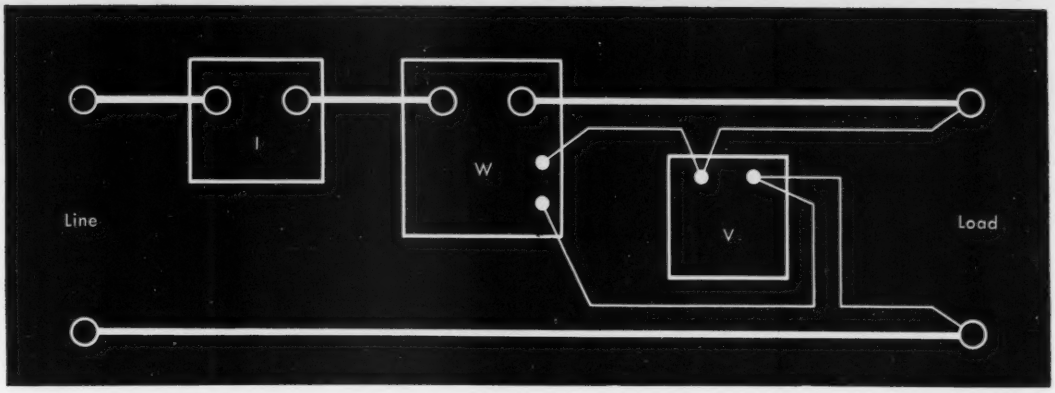
Canada at present has four firms making metal powders, both ferrous and nonferrous. Applications of the powders are not exclusively in manufacturing. Zinc powder is being used to precipitate gold in gold cyanide circuits at the mines. Lead powder is made into a jointing compound for pipe work. Manufacturing uses have tended to concentrate in bearings· filters, gears, locks, business machines, etc. Automotive industries are big users with the modern North American car containing 60 to 70 powdered-metal parts.

Designs must not over-specify

Sintered parts have, however, lagged behind their anticipated market penetration because of the tendency of designers to appraise the process out of context. Where applicable, powdered metal parts are not expensive but specifications in excess of service requirements can inflate cost to uneconomic levels. This shows up when designers, accustomed to wrought metals, call for similar specifications in powdered metals. In consequence, wrought metals have pre-empted some applications for which compacts are better functionally and economically.

It is frequently possible to make a part out of powdered metals costing only a fraction of those nominated because of over-specification. A designer used to working with wrought metals can demand physical properties far in excess of what would be satisfactory in a cheaper metal powder, considering the uniformity of its structure.

In this day of mounting competition, the engineer and manufacturer can no longer rely upon the older methods used a few years ago. Advanced management is emphasizing an examination of all methods and procedures against modern technology. With this background, powder metallurgy shines bright with the promise of increasing applications . . . and increasing profits for those who use it wisely. ★



For the test, connect a voltmeter and wattmeter as above. Alternately an ammeter may be used.

How to test with calibrated motors

Here's how Bruce Newman, P.Eng., of Wagner Electric tests power requirements

A rather recent innovation is the increasing use of calibrated motors for testing the horsepower required for the operation of appliances. These calibrated motors are usually sample motors on which the manufacturer supplies curves of input amperes, watts and speed plotted against horsepower output. The motors are then used to drive the appliances during the tests, and by measuring the motor input and referring to the curves the horsepower loading may be determined quickly and accurately. The motor curves are usually taken on a dynamometer with a high degree of accuracy. However, to obtain the best accuracy in the use of these motors, the following ten precautions must be observed:

1. The calibrated motor should be of a design on which the watts input or calibration is not unduly sensitive to small voltage changes and normal temperature changes. This involves a conservative motor design with moderate flux density, adequate copper density and good ventilation.
2. It is also very important for the motor to have low slip or good speed over the whole range of loads, in order to accurately check speed-sensitive loads.
3. The motor should have a value of bearing friction which is relatively low and is consistent, since once a motor is calibrated, this is the only factor likely to vary.
4. The value of the friction should be checked frequently by testing the no-load watts of the motor at rated voltage or half-voltage, and the complete calibration of the motor should be checked every few years.
5. When the calibrated motor is being used to test an appliance, the voltage should be held at the rated voltage, the motor should be just comfortably warm, and the loads tested should be between 50% and 150% of the motor rating.
6. The voltage and watts input should be measured on accurate instruments, and the horsepower then read off the motor calibration curve. If the load is especially speed-sensitive, the horsepower may be corrected for the actual speed.
7. The instruments should be connected as shown in the accompanying diagram so that the wattmeter and voltmeter potential burden is measured. Then the amount of this burden may be determined by taking a reading of the watts with the load disconnected, and this amount subtracted from all load readings.
8. In many cases, the test may be made with any production motor and the typical or catalogue motor curve may be used. The accuracy will then be not as great as with individual motor calibration, but the load will still be determined within approximately 5% to 10%.
9. Occasionally, the ampere input is used instead of watts, but it is not as reliable since it is subject to far more variation due to voltage changes and differences between motors. Also, on some motors, especially small single-phase motors, the ampere input does not change much with load changes and is not as sensitive an indication of the load. The accuracy of load measurement using current input on large motors may be within 10%, but on fractional-horsepower motors the error may be as much as 30%. For more accurate results the measurement by means of watts input should be used.
10. The calibrated-motor method may be also used for checking the starting, accelerating and maximum torques required by an appliance, or to check the duty cycle operation and other requirements. Since these tests require special techniques in regulating the motor voltage, and controlling the heating and inertia effects, the motor manufacturer should be consulted regarding the use of calibrated motors for these tests.

There are other methods, of course, of determining the power required to drive an appliance or machine. Mathematical calculation is one method. Plain "guesstimating" is another. But neither of these is quite so satisfactory or accurate as the use of calibrated motors. We suggest you try it the next time you have the problem to solve. ★

An IBM 1620 computer. From left: punched card input-output, additional core storage, central processing unit, punched tape input-output.

Still too few engineers have mastered their most useful tool . . . a computer

G. F. Sekely, P.Eng., an IBM engineer takes the magic out of computers; shows how simply they can be applied to engineering problems

The use of electronic computers in engineering and design has become reality in recent years.

However, the number of those who know how these machines work and how to make best use of them is extremely limited. Most of us still associate computers with wiring diagrams, complicated mathematics and some sort of black magic which only very few will ever be able to understand.

This article is intended to give an example of how simply engineering applications can be handled on electronic computers and what actions engineers have to do to solve their computational problems.

We will show two approaches to the same problem, complete with flow charts and coding sheets to demonstrate the possibilities, simplicity and flexibility of modern day programming.

What is a computer?

An electric computer is a machine capable of performing a series of planned logical actions based upon data delivered to the machine, to yield a desired result. Data can be fed to the machines via the input units in punched cards, paper tape or magnetic tape form or from a console typewriter. Results can be obtained on special output units in printed form or on similar media as for the input.

The storage or memory (see Design Engineering, April 1961, p. 50) of a computer is the unit where information — data and instructions required to perform specific tasks — is stored during computation. Every computational procedure involves input, computations, decisions and writing of the desired result.

Defining a program

Even the simplest portion of a procedure has to be specified step by step, together with the logical actions the machine is expected to take upon encountering certain conditions. The complete set of these individual instructions, which will direct the machine to perform the desired steps and computations is called a program.

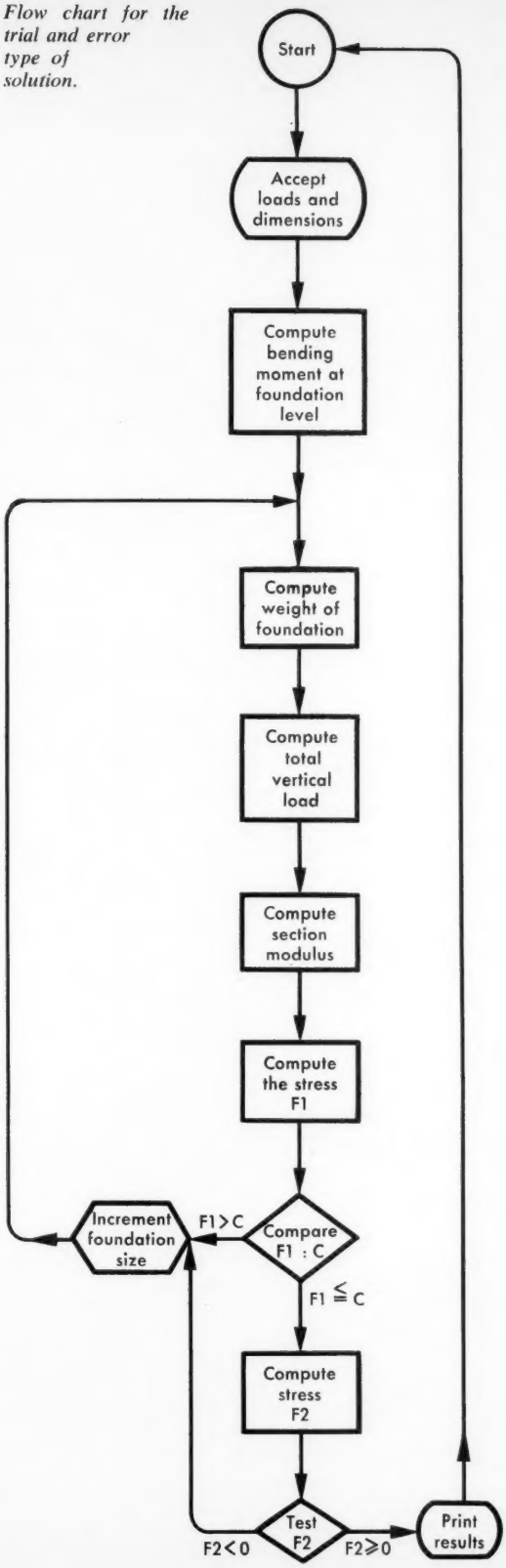
The possible variations of programs provide electronic computers with an almost unlimited flexibility. One computer can be applied to a great number of different procedures by simply reading in or loading the appropriate program into the memory.

To be digestible for computers programs have to be in the specific language of the individual machine. This used to be the language programmers used in communicating with the machines. The procedure, however, was rather slow, prone to errors, and required special skills and knowledge of the particular machines.

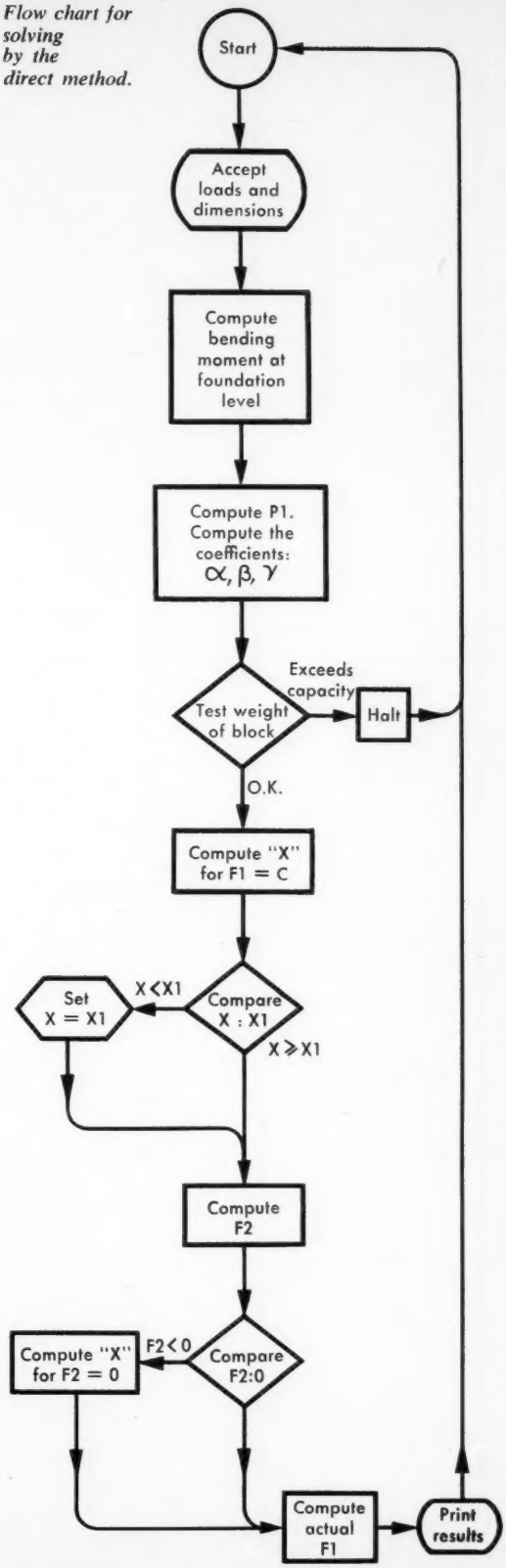
We introduce FORTRAN

To overcome these difficulties, a special FORTRAN (formula translating) system has been created, which takes over much of the tasks the programmer himself had to perform before. It is a language which allows the programmer to state his problems in simple engi-

Flow chart for the trial and error type of solution.



Flow chart for solving by the direct method.



neering or scientific terms and present these statements to the machine. It will produce the required detailed instructions to perform the desired work.

The programmer, therefore, does not need to be familiar with the small details of the hardware. He can concentrate his efforts on the problem rather than on the machine specifications.

The FORTRAN language is so successful that IBM now provides a FORTRAN processor for almost all their machines. Programs written in this language for one type of machine are usually acceptable to other machines with similar capacities.

The two examples shown were written in FORTRAN language for the IBM 1620 engineering and scientific computer.

How to write a program

The procedure in writing a computer program is usually as follows:

1. Preliminary work: definition of the problem and the formulae, together with the input-output requirements.
2. Production of a flow chart, a graphical representation of the required steps and their relations to each other to clarify the over-all computational procedure.
3. Writing the program statements on FORTRAN coding sheets.

Once the program is written and hand checked the statements from the coding sheets will be punched into cards and presented to the machine, which in turn will produce a machine language program from these FORTRAN statements.

The procedure of producing a machine language program from the original statements is called 'compilation' and the standard program which performs this task is called the FORTRAN compiler. This compiler program will not only take the original statements and convert them into machine language, but it will also test for common statement errors and will notify the programmer in an English language message if such errors are encountered in his program.

It is the compiled machine language program which will be loaded into the computer to perform the particular operation, but the person writing the FORTRAN statements does not need to know the intimate intricacies of this machine language version. Testing of the logic and the results is done at FORTRAN level and no detailed knowledge of the equipment is required of the occasional user.

This testing procedure, known as "debugging", used to be very much involved in machine language programming. In FORTRAN, however, it is limited to checking the accuracy and the validity of the individual statements and of the over-all logical correctness of the entire procedure.

Let's work a problem

The problem which we will solve will be to calculate the size of the foundation required for a certain mechanical unit.

Given:

1. Vertical dead load of machinery (kips) = VDL
2. Vertical live load (kips) = VLL
3. Horizontal load (kips) = HL
4. Height of application of horizontal load above ground level (feet) = H
5. Depth of foundation (feet) = D
6. Soil bearing capacity at foundation level (kips/ft.^{2}) = C
7. Size of footing (feet) = X, Y

Calculate the dimension "X" of the foundation so that:

1. The resultant stress at edge 1 under the foundation shall not exceed the allowable soil bearing capacity, "C".
2. There should be no uplift (no negative stresses) at edge 2 of the foundation.

The stresses at foundation level can be calculated from the formula:

$$f_{1,\,2} = \frac{P}{A} \pm \frac{M}{S}$$

where:

P = the total vertical load (kips)

A = area of the foundation (ft^2) = X.Y

M = moment at foundation level (ft kips) = HL (H+D)

S = section modulus of the foundation area (ft^3)

$$= \frac{Y.X^2}{6}$$

Trial and error method

Starting with the minimum allowable size X_1 (determined by the shape of the object erected on the foundation) we compute stresses f_1 and f_2. If f_1 is above the permissible, or f_2 is negative, we increase dimension "X" by a certain finite amount and calculate the stresses again, we do a series of successive iterations until the proper foundation size is reached.

Our first impression would be that this is a rather brute force approach, but if programming efforts have to be reduced to a minimum (even at the expense of some additional computing time) it is a sensible and simple way of obtaining results.

The advantages of this approach are: simplicity, ease of checking, no complicated mathematics or much programming time involved. The main disadvantages are: slower in solution, takes more machine time to finish the computations.

The direct approach

This type of solution is used when the program will be used often, so that the savings achieved at operation time will justify the extra expense of definition and of programming a more sophisticated solution.

The first requirement:

$$f_1 = \frac{P}{A} + \frac{M}{S} = C$$

substituting:

$$P = P_1 + K.X.Y.D.$$

where P_1 = vertical superimposed load and the term K.X.Y.D. represents the weight of the foundation itself, (K is the unit weight of concrete = .150 kips/ cu ft) Also substitute $S = Y.X.^2/6$

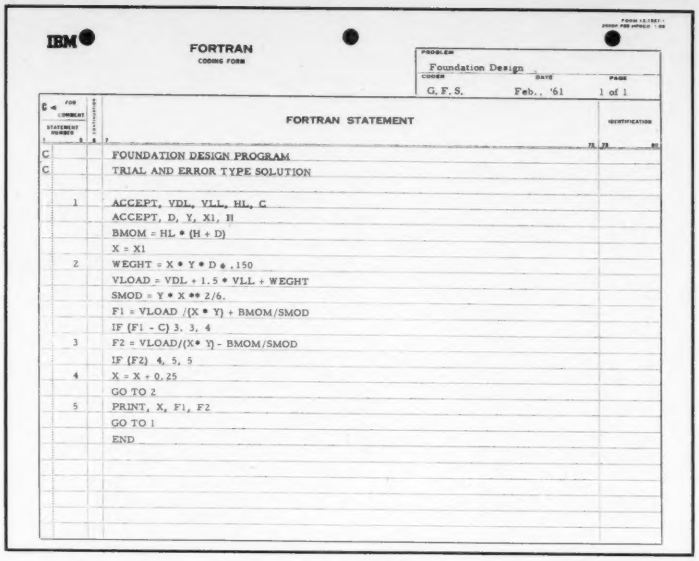
Normalizing the solution we get:

$$X^2(-C + KD) + \frac{XP_1}{Y} + \frac{6M}{Y} = O$$

Calling the individual coefficients of X, α, β and γ the solution can be obtained from the well-known formula:

$$X_{1,2} = \frac{-\beta \pm \sqrt{\beta^2 - 4\alpha\gamma}}{2\alpha}$$

This will give the exact value of X directly, thus substantially reducing computing time.



IBM

FORTRAN
CODING FORM

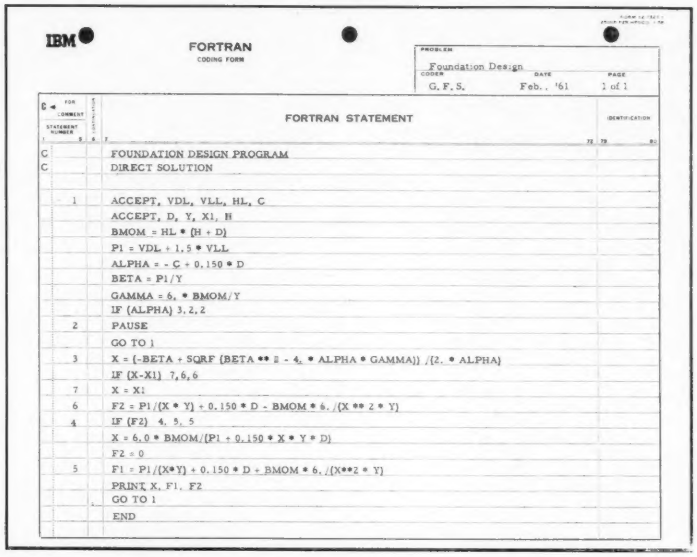
PROBLEM: Foundation Design
CODER: G. F. S. DATE: Feb., '61 PAGE: 1 of 1

FORTRAN STATEMENT

```
C     FOUNDATION DESIGN PROGRAM
C     TRIAL AND ERROR TYPE SOLUTION

      1  ACCEPT, VDL, VLL, HL, C
         ACCEPT, D, Y, X1, H
         BMOM = HL * (H + D)
         X = X1
      2  WEGHT = X * Y * D * .150
         VLOAD = VDL + 1.5 * VLL + WEGHT
         SMOD = Y * X ** 2/6.
         F1 = VLOAD /(X * Y) + BMOM/SMOD
         IF (F1 - C) 3, 3, 4
      3  F2 = VLOAD/(X* Y) - BMOM/SMOD
         IF (F2) 4, 5, 5
      4  X = X + 0.25
         GO TO 2
      5  PRINT, X, F1, F2
         GO TO 1
         END
```

Coding sheet with the program statements for solution by the trial and error method.



IBM

FORTRAN
CODING FORM

PROBLEM: Foundation Design
CODER: G. F. S. DATE: Feb., '61 PAGE: 1 of 1

FORTRAN STATEMENT

```
C     FOUNDATION DESIGN PROGRAM
C     DIRECT SOLUTION

      1  ACCEPT, VDL, VLL, HL, C
         ACCEPT, D, Y, X1, H
         BMOM = HL * (H + D)
         P1 = VDL + 1.5 * VLL
         ALPHA = - C + 0.150 * D
         BETA = P1/Y
         GAMMA = 6. * BMOM/Y
         IF (ALPHA) 3, 2, 2
      2  PAUSE
         GO TO 1
      3  X = (-BETA + SQRF (BETA ** 2 - 4. * ALPHA * GAMMA)) /(2. * ALPHA)
         IF (X-X1) 7,6,6
      7  X = X1
      6  F2 = P1/(X * Y) + 0.150 * D - BMOM * 6. /(X ** 2 * Y)
      4  IF (F2) 4, 5, 5
         X = 6.0 * BMOM/(P1 + 0.150 * X * Y * D)
         F2 = 0
      5  F1 = P1/(X*Y) + 0.150 * D + BMOM * 6. /(X**2 * Y)
         PRINT, X, F1, F2
         GO TO 1
         END
```

Solution by the direct approach is best when the program will be used often.

There are a few conditions though, which will have to be tested before this dimension can be accepted as the final solution.

Program for "trial and error" procedure

The first two lines on the coding sheet are the title of the program and serve for identification purposes only. This fact is indicated by the letter "C" (comment) in column 1.

Statement 1 instructs the machine to accept from the console typewriter the value of the variables: VDL, VLL, HL and C. After these values are entered, the machine will accept the variable dimensions of: D, Y, X, and H. The next statement produces the value of the bending moment at foundation level.

The first assumption for the size of the footing is made: set $X = X_1$, the minimum permissible size.

Statement 2 computes the weight of the foundation block itself. The .150 factor is the unit weight of concrete. Only those statements need to have statement numbers assigned to them which will be referred to elsewhere in the computation.

Next, compute the total vertical load; the value of 1.5 is used as an arbitrary safety factor applied to the vertical live load. The section modulus SMOD is calculated and we are ready now to determine the actual stresses under the two opposite edges of the foundation block.

F1 is computed from the formula $F1 = P/A + M/S$ and the next step is a test, to determine if this value is above or below the allowable soil bearing capacity. The "IF" statement actually allows the computer to take three different routes depending on the value of the expression (F1-C) being negative, zero or positive. If the value of (F1-C) is negative or zero, the capacity is larger or equal to the stress F1 and

the next statement executed should be statement 3. If however, this value is positive — the stress exceeds the capacity — we want the machine to proceed to statement 4.

We do so because if the capacity is exceeded already, there is no reason to test for F2, as the test size was rejected as unacceptable anyway. Statement 4, sets the foundation size to be 0.25 feet larger than before and the calculations are repeated for the new size, and consecutive sizes, until a satisfactory dimension is found, at which time we want to proceed to Statement 3 and compute the stresses under the opposite edge of the foundation block.

If the value F2 is negative, the size has to be incremented further until both requirements (F1 < C and F2 > O) are satisfied. If the value F2, is zero or positive, the calculations are finished and the required information can be printed (statement 5).

After printing the values of X, F1 and F2, the computer is instructed to return to statement 1 to accept input for the next problem.

As can be seen, this solution did not require any mathematical skills at all. The only requirement was a clear definition of the problem and a simple outline, how to obtain the desired result. Let us now have a look at the more sophisticated, or direct approach.

Program for "direct" procedure

The problem is still the same, but computing time has to be minimum and to achieve this, more time is allowed for problem definition and programming. The extra effort invested results in direct formulae for certain conditions, but there is an additional need to test the validity of the solution.

Coding starts in exactly the same manner as for the previous program, allowing for the input of the design variables and computing the bending moment at the foundation level. This is followed by the computation of the P1 component of the vertical load; the dead load of the apparatus plus the expected live loads multiplied by a safety factor of 1.5. The individual coefficients needed in the direct solution, Alpha, Beta and Gamma are computed.

If the factor Alpha is positive or zero, this means that the weight of the concrete block in itself exceeds or is equal to the soil bearing capacity. As this solution is not really acceptable, the computer is instructed to go to statement 2, pause, and after restart go to statement 1 to accept the input for the next problem.

If Alpha is positive, the capacity is sufficient to carry the weight of the structure. Statement 3 is executed and a direct solution is obtained for the value of X for the condition F1 = C. At this state, we test if the obtained "X" value is above or below the specified minimum value of "X1". If "X" is smaller than X1, statement 7 substitutes the minimum value X_1 for X.

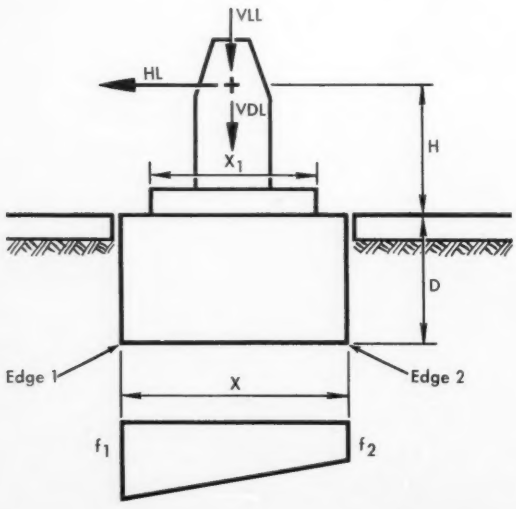
The stress under the opposite edge, F2, is computed and if it is negative — uplift condition — a new larger X value is calculated to meet the requirement F2 = O. For all cases, we calculate the final value of F1, print the desired results and return to statement 1 to accept input for a new problem.

This program will give a much faster solution but time was required for an exact definition of the problem and because of the more involved, through simple mathematics, the program is more prone to errors in definition and will require time for verification.

The two solutions given show two approaches for the same problem. The decision of which type of approach to take is dependent upon the type of problem, the complications involved, the number of times the program will be used in a given period, the experience of the programmer and the urgency to have the program ready and operational by a given time.

The conclusion can be drawn now, that most problems can be solved in a relatively simple manner on electronic computers, and programming in FORTRAN language does not require any special skills but plain common sense and familiarity with the basic engineering principles.

It is found that writing in FORTRAN — because of the requirement for a clear definition — will actually help in better understanding of engineering problems and will provide the engineer with a more solid background in their every-day work. ★

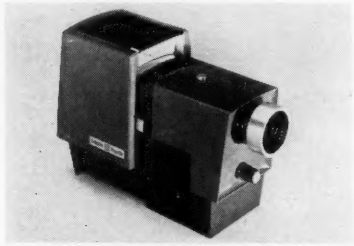


Determining the size of a foundation for a certain mechanical unit is simplified by using an appropriate computer program. Diagram describes the sample problem.

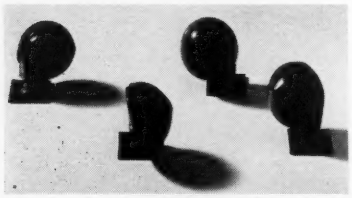
Britain is swinging to functional design

1961 Design Centre Awards show the newest design trend has hit Britain

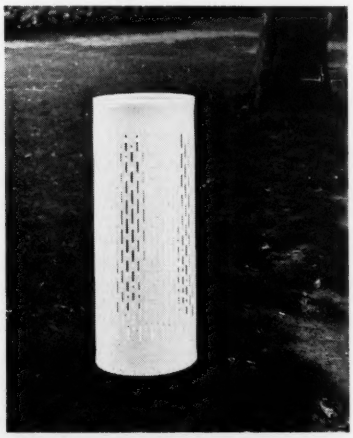
This award-winning table mirror has a lacquered brass frame on a black stove enamelled steel stand.



A polystyrene encased projector which stacks slides neatly in a built-in box after viewing.



Casters have a pre-lubricated free spinning dome on enclosed bearings and can be aligned at first touch.



The bin, of perforated sheet steel, engages in a heavy fixed base incorporating an optional locking device.

The ever-growing tendency throughout the world to look at industrial design through functional engineering eyes rather than over the artist's palette is now becoming evident in Britain. This year all thirteen recipients of the Design Centre Awards reflected stark simplicity and functional design, setting a marked divergence from past preferences for color and pattern, rather than form or line.

This year, also, there were no carpets, fabrics or wallpapers on the prize list. But whether the product was a well established type such as a towel-rack or something newer like a slide projector, top marks were awarded for simplicity and economy of means, along with proper use of materials.

The Design Centre Awards were made from more than three thousand exhibits which stood in London's Design Centre during 1960. Each year the Council of Industrial Design selects new products for display from a long list of contenders. Products are restricted to consumer durables (this does not include autos) and may range from home lamps to street lights or even garbage cans.

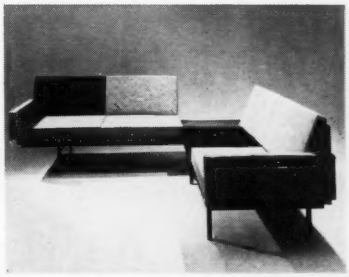
Radio wins Duke's prize

Top yearly honor is the Duke of Edinburgh's Prize for Elegant Design which is chosen by a panel chaired by Prince Philip himself. This year it went to Eric Marshall, FSIA for the design of a portable transistor radio. Encased in a high compact polystyrene cabinet with expanded aluminium grille, the set is powered by two six volt batteries and weighs 5 lbs. Judges decided the designer had achieved a clean, trim and attractive effect in plastics. The prize: something worth about $300 which can take any form the winner chooses, provided it can carry an inscription. Winner may design it himself or commission another designer.

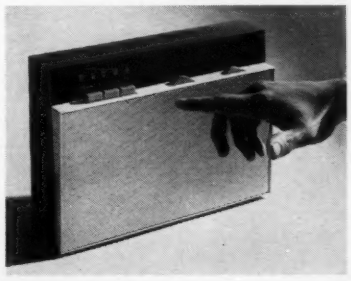
Another prize winner was a table mirror which the judges chose because it "swivels easily yet stays firmly in any required position." They also considered it a craftsmanlike job which was well detailed and reasonably priced.

Perhaps these comments almost exaggerate the trend to a functional engineering approach. But the judges even chose a set of furniture casters made of a zinc alloy base because: "fresh thought has been given to an accessory which is normally taken for granted, yet often the appearance of a chair for example, is ruined by ugly casters."

Also included in the prize list were an oil fired boiler, a set of saucepans and a folding outdoor chair. And remember we said the products eligible for display in the Design Centre included even a garbage can. This year a park litter bin won an award because it looked attractive and was easy to keep clean. ★



These black finished steel base frames with plastic feet will take a variety of interchangeable units.



Top prize winner was this transistor radio with grey, black and white cabinet and silver grille.

Light-weight drag-buckets made of non-sparking magnesium are ideal for handling grain in ships' holds where there is a danger of dust explosion.

Our designers re-discover magnesium

A Canadian company has created new end-uses for magnesium, proving its profitable use in design with products from ladders to brick tongs

By Ken Campbell

Designing and manufacturing new Canadian products from Canadian magnesium is the business of Aerometal Products and Design Limited, of Toronto. This is the express purpose for which it was established in 1955 by its parent company, Dominion Magnesium Limited.

Dominion Magnesium originally had no intention of entering the secondary manufacturing field. Their business was making magnesium. But to make a profit on their basic material there had to be an end-product market. Since the engineers of Canada were rather reluctant (and we don't know why) to take advantage of this new material, Aerometal was created to develop new end-uses. And this is exactly what they have done.

A future for magnesium

We talked to Mr. Z. Jarmicki, P.Eng., the manager. He holds high hopes for the future of this company—and more particularly, for the future of magnesium. These hopes are gradually becoming reality. In his own words, "We are moving very slowly and carefully, and doing quite well. Every one of our products has been a success. Industry has accepted our products." From this statement we might conclude that industry must also be accepting magnesium. But this is not exactly true, as engineers still seem backward about putting this lightweight material to its full usefulness.

Magnesium has advantages

Since its initial popularity with the aircraft industry during the Second World War, acceptance of magnesium has been relatively slow. Mr. Jarmicki feels that possibly this is because many designers are still unfamiliar with its properties. They may even retain some of the old prejudices, such as it being a fire hazard and too expensive to use in competitive industrial applications. "But neither of these assumptions is true," says Jarmicki. "Magnesium is as safe to use as wood. The slight chance of a fire starting in the factory can be avoided by good housekeeping. And as for cost —

why, magnesium really costs no more than aluminum. Certainly, by the pound it's more expensive, but don't forget a pound of magnesium has approximately one-third more volume. This means that with magnesium, with its high strength-to-weight ratio, a lighter product can be made at about the same cost."

The lightest of the commercially used structural metals, magnesium is nonsparking and resistant to most alkalies and many organic chemicals. The three main metals alloyed with it are aluminum, zinc and manganese. These improve its structural strength and resistance to corrosion. A notable quality of a magnesium alloy is its ability to absorb dynamic energy, which makes it particularly suitable for such things as propellor blades and aircraft landing wheels.

A typical new application

A new product, an aircraft refuelling ladder designed by Aerometal for use when refuelling both the 707 Boeing and the DC8 Douglas, is an example of how magnesium can be profitably used in design. A step-type ladder, it is collapsible, of welded construction, and fabricated completely from standard magnesium stock. It is equipped with hand rails and has two solid grill-work platforms, one mounted 1 ft. 3 in. above the other. The top platform is used when refuelling the DC8 Douglas, and it can be swung up and out of the way when the ladder is being used for the Boeing 707. Despite the sturdy construction, it weighs only 48 pounds, and can be set up under the wing of an aircraft, collapsed, dragged on the wheels mounted to its rear legs, and loaded onto the fuel truck with ease.

A smaller version of this ladder is being contemplated for use in the home. As Mr. Jarmicki points out, "The handrail will be appreciated by the housewife." Aerometal is already manufacturing another line of step and extension-ladders for home and industry, as well as other specialized ladders for use with aircraft, such as an extension ladder designed to reach the top of the tail-fin of a Viscount. Although it is equipped with handrails and platform, and extendable to 40 feet, it weighs only 120 pounds.

Snowshoes and brick tongs

Ladders are only one type of product that Aerometal Products manufactures. In fact, the variety of its products range from rigging blocks to brick tongs. This is achieved because the factory is geared for quick change. Flexibility is the by-word. Within a short time, production can be changed from the manufacture of builders' hods to the manufacture of platform trucks, from snow pushers to brick tongs, from hand trucks to dockboards, from grain handling equipment to snowshoes.

Besides the standard model snowshoe, there are three other models on the market and these have been given the Indian sounding names of Bears Paw, Shallow Nose and Big Brother. This seems appropriate, for they are made according to the same snowshoe design that the Indians have been using for centuries. The difference is in the materials. Where the Indians used wood, the frame is of extruded magnesium. Where the Indians used leather thongs, the frame is strung with galvanized steel cable covered with nylon.

Because it is nonsparking, magnesium makes an excellent material for grain handling equipment such as large power-type shovels and scoops, which are used in grain elevators and ship holds where there is ever present the danger of a dust explosion. Also, due to its lighter weight, this type of equipment has shown an appreciable reduction in operational costs.

But the "big field" for the future, according to Mr. Jarmicki, is reels—magnesium reels for production and wire transport.

The market across the border

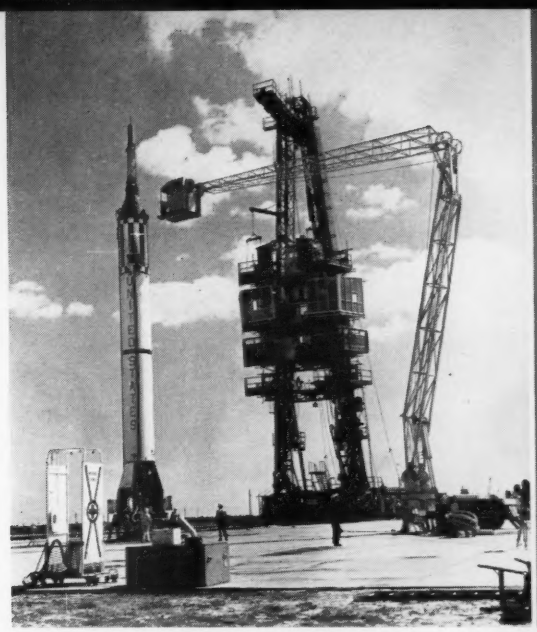
Export prospects look good. Even though Aerometal Products and Design Limited has been in operation for only a little over five years, it has already worked its way into the foreign market. The United States has been a good customer, especially for grain handling equipment. In this case, as in most others, the kind of product we need, they need. If with ingenuity we can do a better job at a competitive price, then they will buy.

Whether for the home market or export, Mr. Jarmicki feels that by using magnesium, Aerometal Products will be able to do a better job at a competitive price. ★

Ladders for home and industry are now made of magnesium. This one has a handrail for the householder.

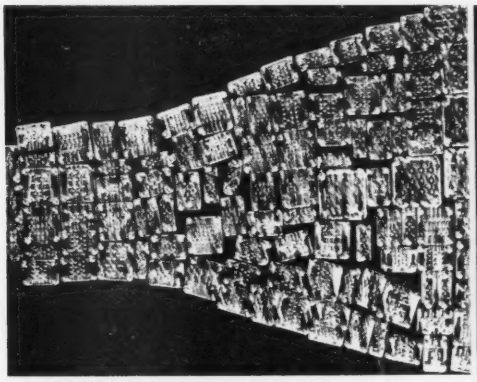
Designews in pictures

The inside story of Project Mercury, a design achievement

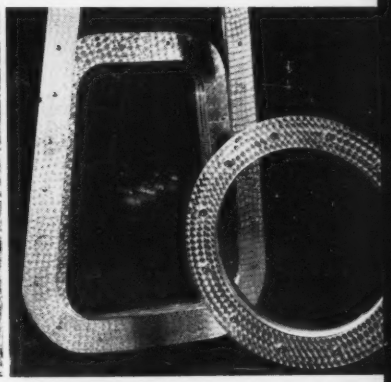


Mercury Capsule #7 atop its Redstone booster. Tower, designed by Mobile Aerial Towers Inc., provides emergency evacuation at final countdown.

Three small rockets carry the capsule to safety as it escapes from the booster.

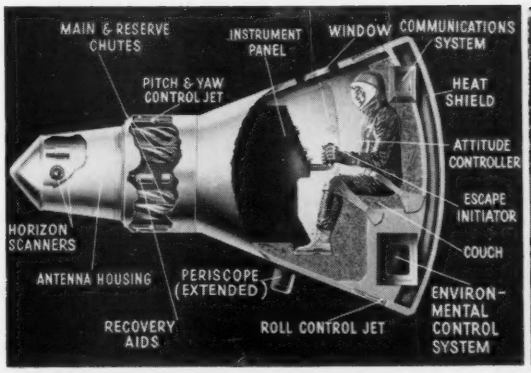


Some of the 116 relays made by Leach Corporation for the capsule. They were literally advance tested to destruction.



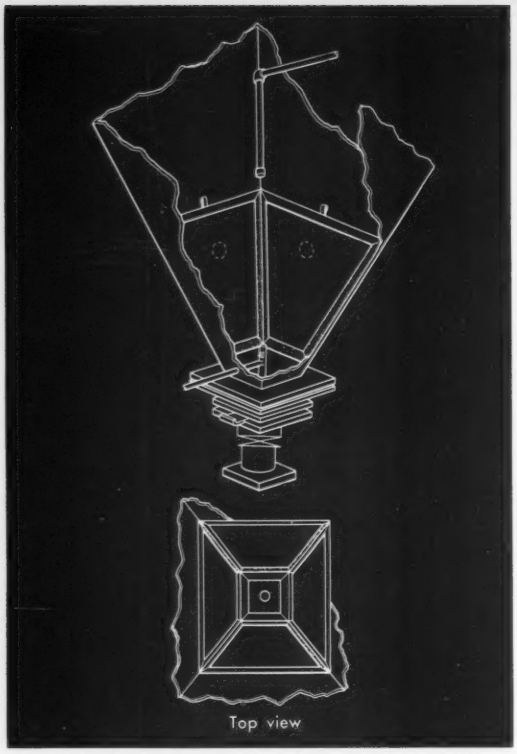
Viewports similar to those through which the Astronaut saw the U. S. coastline.

◀ *Inside the Mercury capsule the astronaut is surrounded by instruments for checking his progress through space and for controlling the spacecraft's altitude once it has escaped the rocket booster. In flight the astronaut is actually lying on a form-fitted foam-rubber couch.*



This artist's simplified version shows the major systems in the Mercury Capsule #7 which carried the first American into space.

The engine, made by Rocketdyne, which launched the Redstone into space.



Sectional view of porous stainless steel bin liners used in hopper for weigh belt feeder.

Porous ss panels increase bin flow

Installation of porous stainless steel bin liners solves materials handling problem

The increased use of automatic feed equipment in all fields calls for increased use of storage bins with controlled output rates. The problems inherent in bin flow of powdered or fine materials include bridging, caking and uneven flow rates. When such flow is maintained to a weight feeder system, lack of reliable feed becomes critical. Even in such operations as filling, unreliable operation of bins creates delays, annoyance, and in the long run, poor customer relations.

The problem of poor bin discharge which plagued one large synthetic fibre manufacturer was solved in a novel manner, while, at the same time, increasing discharge capacity by at least threefold. Poor flow of powder was seriously hampering production: the quantity was too small, the material bridged in the bin, stopping flow completely, and shutdowns were too frequent for sustained operation.

Where vibrators or shakers could normally be expected to provide satisfactory results, they were totally ineffectual here. The material persisted in bridging and flow was persistently unreliable. A new approach was needed.

Inert gas solution

An attractive solution to the problem was aerating or fluidizing the powder by means of inert gas or compressed air blown into the packed, almost-solid powder. In this particular instance the inert gas had to be nitrogen. This was to be done by blowing the nitrogen gas through porous stainless steel panels lining the bin to provide a gaseous coated frictionless bin wall and by blowing additional nitrogen into the packed powder by means of perforated probes.

Responsibility for developing this idea fell to a design group, a materials handling group, and a process group at the company. Initial trials were made with a variety of materials, including porous stone and woven fabric, but these proved unsatisfactory. Nonuniformity and contamination of the product due to impurities and linting prevented the use of these materials. It became obvious that a completely new approach would have to be taken and an as yet untried solution devised.

Investigation showed that large panels of uniform porosity sintered porous stainless steel possessed the right combination of properties needed for creating and dispersing a multitude of fine gas bubbles. The properties of pss promised to keep product contamination to zero while the uniform porosity with controlled pressure drop could save considerable quantities of nitrogen. Only a quarter as much nitrogen would be required with pss panels as compared with other porous materials.

Four ss panels

The design called for use of four porous stainless steel panels in the throat of each bin, and, in addition, for porous probes to be placed farther up the bin wall and along the valleys to prevent possible localized bridging. The porous panels were to be installed without removing any sections of existing bin walls and were, therefore, "hung" on the existing walls. The only cut made in the existing walls was for the gas supply.

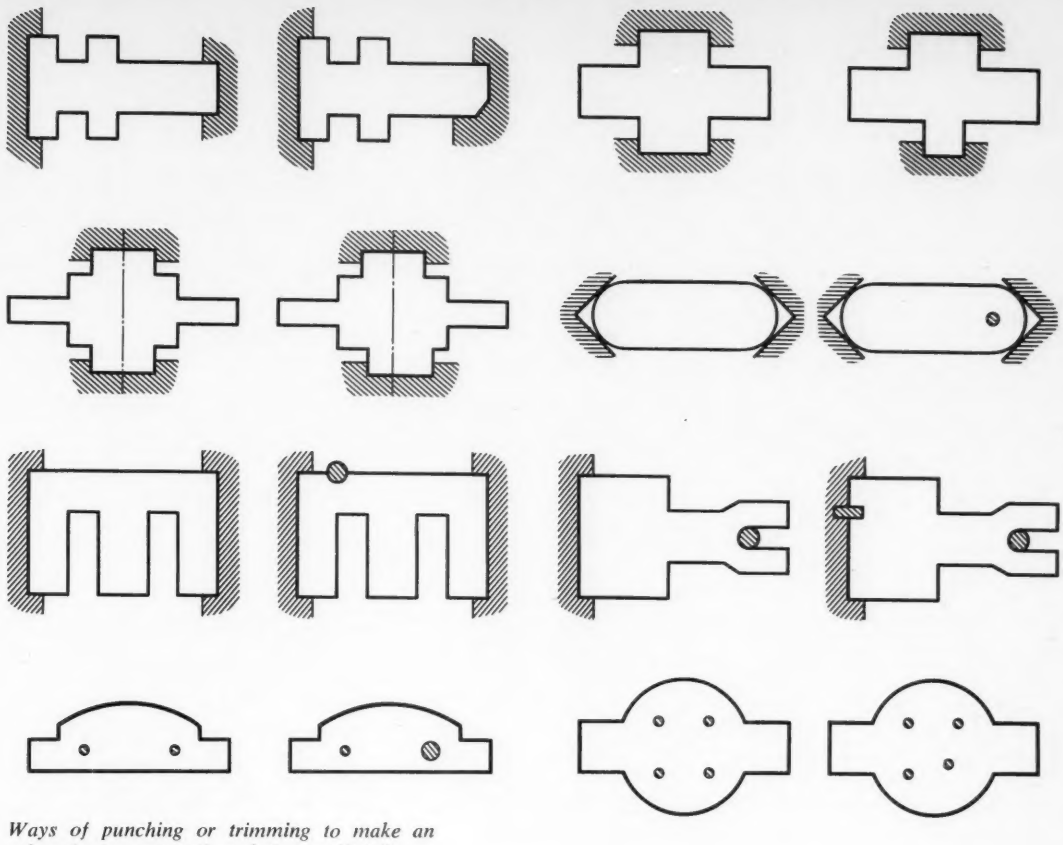
When the discharge valve was opened, flow was instantaneous, the powder was fluid, and the flow to the weigh feeder was smooth and even. Several calibration runs were made to optimize the gas requirements. Final gas rates established for the probes and panels were as follows:

probes — 0.2 cfm each
panel —0.5 cfm each

A run was made to determine the ultimate capacity of the bins with the new system.

This was the first such application of this material. Sintered porous stainless steel had been used in fluidized bed processes, and in other types of walls, such as in aircraft de-icers. The use of porous stainless steel in bins to eliminate flow problems was novel. Besides the low initial cost and low operation costs, no moving parts existed requiring maintenance and repair. Other equipment, such as shakers, were not needed, permitting some reduction in total space requirements.

The success of this initial installation has led to the consideration of similar bin liners at a new plant to be constructed in the near future. ★



Ways of punching or trimming to make an otherwise symmetrical workpiece artificially unsymmetrical.

Foolproof ideas for nesting stampings

Eight practical basic methods to make workpieces easier to align

Many occasions occur where symmetrical stampings must be processed with one given side of the component in a set position. This happens, for instance, with electrical laminations, which must be stacked so that all the insulated surfaces will lie in the same direction. Another example is the case of bent, or formed components, where care must be taken that the burr side of the stampings corresponds to the inner side of the bend. In addition, there are cases where the burr side must be considered for functional reasons, such as assembly with other components. Finally, the burr side can be most important in the case of subsequent shaping.

In all these examples it is quite simple to make the workpiece artificially unsymmetrical by adding some supplementary punching or trimming operation to the stamping operation. In this way the nesting of the blanks or workpieces can be made almost foolproof. And, since these components are usually produced with progressive type dies, there is no additional charge for the supplementary operations; however, the die costs are usually a little higher. This cost can be readily offset by the reduction in waste from inverted parts.

There are several different practical basic methods for making the otherwise perfectly symmetrical workpiece unsymmetrical. The accompanying sketches illustrate some of the most commonly used.

These irregularities are ideal for ensuring that subsequent operations such as stacking, forming, etc., are performed as designed. One standard procedure for gaining proper alignment is to use alignment pins in the stacking fixtures. These permit the workpieces to be put in their places only if fed in properly. ★

Ceramic design becoming stagnant?

A Canadian designer has a long, hard look at an industry which he claims is undermining itself through lack of initiative

A Canadian industrial designer recently told the American Ceramic Society in no uncertain terms that they have failed to come up with even one outstanding design development in the last decade. Speaking as a panel member before the Design Division of the Society, Toronto's Sid Bersudsky, ASID, had this to say:

"When invited to address your society, I thought it might be a good idea to take a look at the achievements of your industry one hundred years ago—paying particular attention to consumer products which were mass produced and merchandized then. Imagine my surprise, bewilderment, and frustration at what I saw! My sources . . . old books, prints, and catalogues . . . showed ceramic tile—floor and wall variety—in patterns, glazes, and finishes very similar to your current designs which look out at us from the pages of today's magazines. These are the same designs which the Victorians borrowed from the Greeks, the Romans, and the Orient—the same ceramic vase shapes I see in department stores today in New York, Toronto and London—the same old lamp bases, ash trays, and other ceramic trivia which contribute little to human well-being—either functionally or aesthetically.

"Apart from the building field, I believe that the ceramic industry has made no significant contribution to the field of consumer goods in the last decade. This is the area which offers the greatest promise—and you neglect this area at a time when a new trend has appeared in research and development. I am talking about the trend which emphasizes the human factors in design and product improvement. This increased concern with human comfort and well-being has been accelerated due to the limited capacity of people to adjust to physical changes in their environment. Human factor specialists tell us that an individual's performance—whether it be an astronaut, a factory worker, or a housewife—is greatly influenced by such environmental conditions as proper lighting, adequate noise control, comfortable body temperature. All these human factors pose a tremendous challenge to you, the producers of consumer goods. Bold exploration and innovation is indicated here—on an industry-wide level. And provided the ceramic industry is prepared to meet these new challenges with an open mind, substantial rewards can be yours.

Do-it-yourself attitude

"Frankly, it is my impression that your industry is inclined to a 'do-it-yourself' attitude when it comes to bold design thinking. Yes, of course there are a number of excellent designers working within the industry. That is as it should be. I would like to make it quite plain that I firmly believe it is vitally necessary to have strong and active design specialists working exclusively within the industry. Your industry design specialists are familiar with the technological and sales problems peculiar to the ceramic industry.

"I'm suggesting, however, that the independent consultant designer has much to offer as a stimulating force, working in a collaborative relationship with your own designers. This is being done by some forward-looking manufacturers. But, taking a broad cross-section of the industry—both in the United States and in Canada—the 'do-it-yourself' policy seems to prevail. As a result, many consumer needs are not met—or even anticipated—and many markets are neglected.

"Looking for a moment at the Canadian market, it will surprise you to know—as it surprised me—that very few United States firms really study this market, or the Canadian consumer. It will surprise my fellow Canadians even more that very few of our own industries make a careful evaluation of either the Canadian or export markets. The Canadian ceramic industry seems to be content to follow the satellite's role, and to orbit the U. S. industry. I know of no important ceramic developments in Canada. Although the Canadian ceramic industry has shown very substantial annual sales volumes, when you analyze these figures, you will find that the Canadian building boom has contributed a major percentage to this amount. In other words, your industry in Canada particularly—and I believe this is also true of the United States—is in a reasonably healthy position due to the building boom we have experienced. Developments outside the field of building seem few.

New materials replacing ceramics

"Many exotic new materials are replacing ceramics, and competing for the consumer dollar. Your technology is many years ahead of your production, and your industry can provide leadership to the western world in the form of bold, imaginative new applications for ceramics.

"We have all heard about the long undefended boundary between the United States and Canada. As you know, there are no design fences between our two countries. Many of your technological developments are freely passed along to your Canadian counterparts, and are used to good advantage. Many of your designs, both good and bad, are copied 'ad nauseam' by Canadian producers who thus save development costs.

"It is high time that international patent laws and copyright laws were updated. It is time that original product development was respected and protected on an international basis. Design is a valuable investment, and it should be protected internationally.

"Now comes my final point. I've mentioned our own undefended border, and I've talked about better international design protection. How do we achieve the latter—and more broadly—how do we North Americans go about earning the international respect we so desperately need in the world? I do not know the total answer. But I do know that one of the keys of the composite whole answer lies in the industrialist's approach to his industry counterpart abroad. The North American attitude to like industries of other countries has been wildly insular for too long. We have oversold ourselves on good old American know-how, without bothering to learn the language—either literally or figuratively—of our foreign competitors." ★

New ceramic mold process for tools and dies

Fast, economical production of complete shapes is possible

A comparatively new metal casting process uses a ceramic-mold technique to produce tools, dies and structural components. The Shaw process allows fast, economical production of complex shapes of unlimited size, as well as a complete range of tools including lathe chucks, milling cutters, end mills and broaching tools. It uses any castable die material suitable for die casting, forging, stamping or plastic molding.

While they may be difficult to machine, conventional hot-work tool steels are said to be ideal for the Shaw process. In some cases cast die cavities and cores can be produced for little more than the cost of the raw block of steel for equivalent machined dies.

Though relatively new on this continent, the process has been used in Europe and Asia. A major Japanese automobile manufacturer has produced stamping and forging dies weighing as much as 3½ tons, as well as die casting dies, permanent mold patterns and metal patterns for shell molds.

The advantages of the process stem from an unusual ceramic material used in the production of the mold. The material introduces the phenomenon of "micro-crazing", which under the microscope has the appearance of wire netting. Gases and air escape from minute fissures or air gaps; this eliminates porosity, cracks, surface inclusions and other possible defects which occur during conventional casting operations.

The Shaw method also allows hot metal to be poured directly into a cold mold, a situation unthinkable with other ceramic bodies. This benefit in turn stems from the "breathing" of the ceramic particles, which gives the mold complete resistance to thermal shock and virtually zero coefficient of expansion.

Designers attending a recent technical conference of the American Society of Tool and Manufacturing Engineers in Los Angeles saw the process demonstrated at the booth of Shaw Process Development Corp., a division of British Industries Corp. Among the products shown were forging die inserts used in the automotive industry to produce steel wheel guides for one of the new compact cars. The inserts were cast in hot work steel and used in the "as cast" condition.

Forging die for producing carbon steel wheel guides for one of the new compact cars. The die inserts are used in the "as cast" condition.

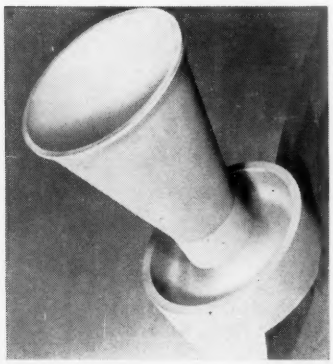
Difficult Spiral Design

An example of die casting dies were cavities used for die casting an aluminum auto horn. The horn has a concentric, spiral design which would have been almost impossible to produce through any conventional die-making technique.

Also on display were Shaw castings used in missiles and jet engines, including a turbine housing used on the Atlas, Jupiter and Thor missiles. Another casting was an experimental nozzle for a small missile cast in 4340 heat resisting steel.

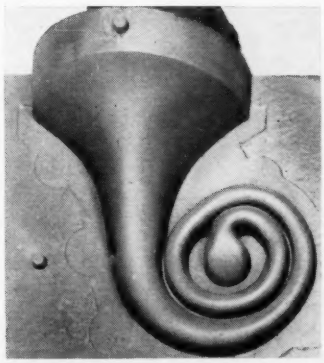
Die casters have found that the process offers excellent die life and casting finish. There are savings both in time and money where multiple cavities are required or where there is a rapid replacement of die components due to early heat checking or wear.

The process casts forging dies for drop forging, press forging and swaging machine dies. Among the advantages are that worn dies can be remelted and that die inserts can be run without a bolster block. ★

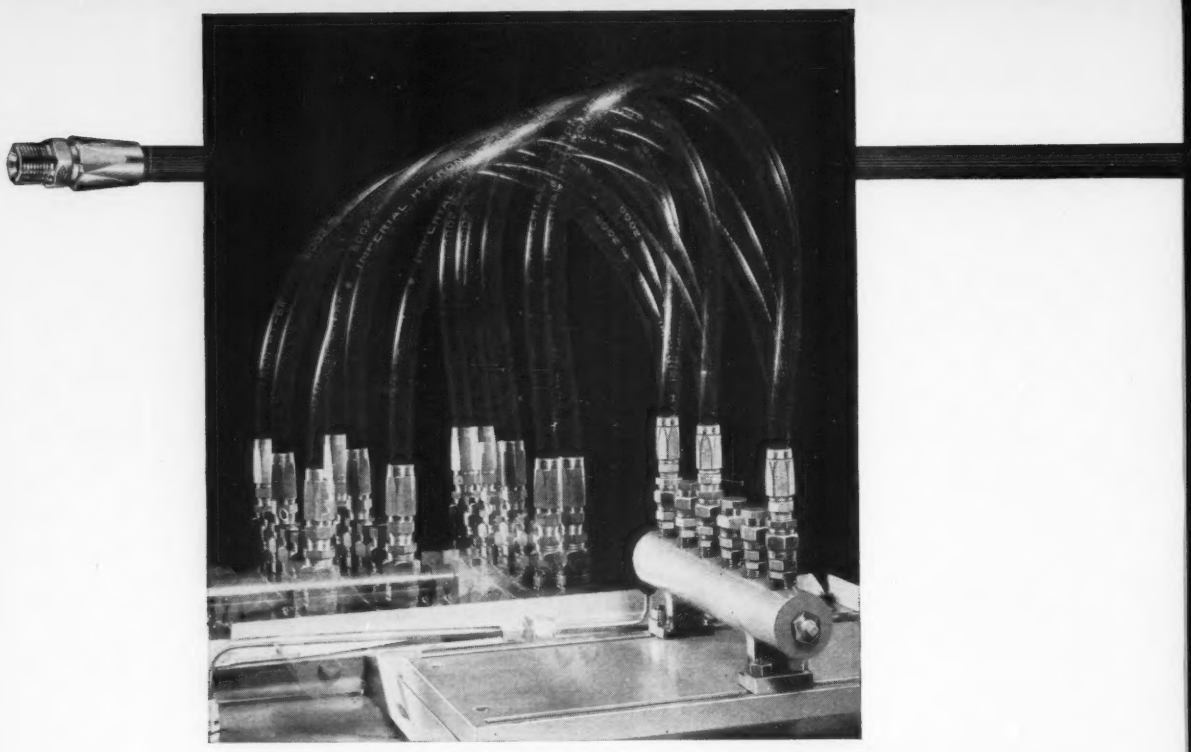


Casting of an experimental nozzle for a small missile.

Turbine housing used on the Atlas, Jupiter and Thor space missiles.



Die casting of an aluminum automobile horn.



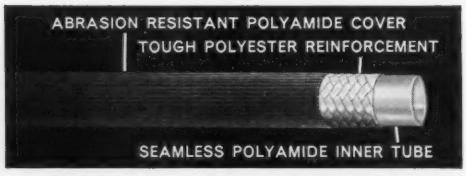
Hytron® hose delivers

7 TIMES THE FLEX LIFE

of wire braid hose

No need to pamper Hytron Hose. It lasts long, saves money on many applications. Hytron also has a wider range of uses than wire braid hose because it is more compatible to different fluids—mineral or synthetic fluids having a water or phosphate ester base.

Extra-long flex life and compatibility are *only two* of the outstanding advantages of Hytron Hose. For more information, see the next page. And write for detailed report and test results—Bulletin NEPR-500.



HYTRON

IMPERIAL EASTMAN

Imperial-Eastman Corporation General Offices: 6300 West Howard Street, Chicago 48, Illinois

Imperial-Eastman Corporation (Canada) Ltd., Barrie, Ontario • Imperial-Eastman, S.A., Apartado Postal 26544, Mexico 13, D.F.

For further information mark No. 128 on Readers' Service Card

Briefs

Noisy topics: Husband beware; most **annoying sound** in the world is scraping a saucepan with a knife, according to Britain's National Physical Laboratory which has just studied all kinds of noises . . . **supersonic** passenger aircraft are likely to be less noisy in flight than their subsonic counterparts, says Dr. A. E. Russell, leader of a design team studying supersonic transport in the UK . . . here's welcome relief for suburbanites; noise has almost been eliminated in a new **lawnmower** with an electric motor powered by lead-acid battery . . . and **harassed parents** will be happy to hear that an ingenious toymaker has simulated the whine of bullets with a tiny zinc-alloy block automatically die cast around a piano wire that is struck by the trigger of a toy pistol . . .

Towards better reading: To read technical reports, or even weekend papers faster, Columbia University has a program for teaching **busy executives** to read and absorb printed text at better than 500 words per minute . . . and if you fancy yourself as a fast reader remember that some banks are installing machines that can read up to 500 characters **per second,** and sort checks as well . . .

News of metals: Use of **powder metals** in automobiles is increasing; jumped from 4 lb per car ten years ago to about 7 lb today . . . lead wire woven into drapery fabrics will help arrest noise in **sound-proof** curtains or partitions for schools, offices and hotels . . . highway authorities in Ontario and Quebec are testing aluminium **snow plows** that reduce the weight bearing load from 1800 to 700 lbs . . . recent research has revealed that calcium and zinc molybdates equal or exceed **rust preventative** qualities of red lead and other common inhibitors . . . Kolene Corp., Detroit has won the North American licence for a new West German **nitrogen** metal treatment to increase wear resistance . . . Conversion Chemical Corp., Rockville has developed a product for brightening and corrosion protection of **cadmium plate** in a single dip . . .

For lady drivers: In Northern Ireland a firm has invented "unbreakable" highway guide posts that give way when struck by a careless driver, and **spring back** into position; made of rubber and cored with spiral spring they are reinforced at the base for fixing in concrete . . . and in England research

Briefs — *continued*

workers are testing a new **lamp post** of thin sheet steel which crumples at the base when struck by a car, acting as a buffer and damaging little more than the bumper or fender . . . but before we leave the subject of transport, a French firm is turning out **air-cushion skis** to give the experts more speed and precision, and the unsure-footed greater ease and confidence . . .

The heat's on: Why shovel snow when newly developed infra-red ray heaters can **melt the flakes** before they hit the ground; heat rays do not heat the air they pass through, just warm the objects they strike . . . U.S. Joint Industry Committee on ballast heating fixtures has called for development of a new specification "ballast heat test" to include all elements of **heat transfer** normally encountered in fixtures . . . research into thermoelectric systems may provide automobile heating and cooling by a battery powered unit with **no moving parts** except for a fan . . .

Hear and their: Eavesdroppers, industrial spies and converted **telephone-tappers** will now have to contend with portable radio scramblers for FM mobile radio or radio-telephone networks . . . medical scientists at the University of Saskatchewan are working on a device that will take an electro-cardiogram of a heart patient and **transmit** it for recording at the doctor's office; that way the doctor can determine what kind of activity his patient should avoid . . . British American Oil president E. D. Loughney forecasts that sales of **natural gas** and by-products should contribute $270 million annually to Canada's economy by 1965 . . . Century 21 International Exposition in Seattle next year will be landmarked by a 600 foot high symbolic **space needle** with a revolving restaurant near the top that will treat patrons to a panoramic view of the city . . .

All at sea: The first U.S. **free-piston** merchant ship, Gas Turbine Ship William Patterson has successfully completed a six month circumnavigation of the world . . . Research-Cottrell Inc. has won a U.S. Navy $1 million **contract** for 30 air-cleaning precipitators for nuclear subs . . . Sperry Gyroscope Company of **Canada** has won a contract to tune and test electronic equipment for six new destroyer escorts for the Royal Canadian Navy . . .

Talepiece: A design engineer told us the other day he returned a "do-it-yourself" kit to the store where he bought it. He couldn't open the package. ★

LIST OF DEALERS

BRITISH COLUMBIA

Clarke & Stuart Co. Ltd.,
Vancouver, B.C.

Frederick Goertz Ltd.,
Vancouver 5, B.C.

Vancal Reproductions Ltd.,
Vancouver 5, B.C.

Diggon's,
Victoria, B.C.

ALBERTA

The Alberta Drafting & Blueprint Co. Ltd.,
Calgary, Alberta.

Calgary Drafting & Blue Print Co. Ltd.,
Calgary, Alberta.

Northern Drafting & Blue Print Co. Ltd.,
Edmonton, Alberta.

SASKATCHEWAN

Norcal Reproductions & Engineering Supplies Ltd.,
Regina, Sask.

Precision Instrument Service,
Saskatoon, Sask.

Prairie Technical Equipment Ltd.,
Saskatoon, Sask.

MANITOBA

Fraser Art Supplies Ltd.,
Winnipeg 2, Man.

W. J. Dick & Co. Ltd.,
Winnipeg, Man.

J. Lewis & Co.,
Winnipeg, Man.

ONTARIO

Martlin & Lawrie Limited,
Hamilton, Ontario.

Rapid Blue Print Ltd.,
Hamilton, Ontario.

Mercury Blueprinting Co. Ltd.,
London, Ontario.

Evans & Kert Ltd.,
Ottawa 4, Ontario.

Atlas Helio Ottawa Ltd.,
Ottawa, Ontario.

Martlin & Lawrie Ltd.,
Ottawa 4, Ontario.

Commercial Photo Copy Ltd.,
St. Catharines, Ontario.

Manleys Ltd.,
Sarnia, Ontario.

H. G. Barter & Son Ltd.,
Sudbury, Ontario.

Atlas-Helio Co. Ltd.,
Toronto, Ontario.

Curry's Art Store Ltd.,
Toronto, Ontario.

Edmunds Art Supplies,
Willowdale, Ontario.

Copeland's Bookstores Ltd.,
Windsor, Ontario.

QUEBEC

Atlas-Helio Eastern Co. Ltd.,
Montreal, Quebec.

British Blue Print Co.,
Montreal, Quebec.

Instruments Lafayette Enr.,
Quebec, Quebec.

J. A. Y. Bouchard Inc.,
Quebec, Quebec.

NOVA SCOTIA

Mahon's Stationery Ltd.,
Halifax, N.S.

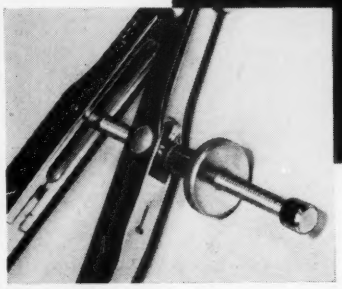
ALPHA

FABER-CASTELL

NEW DESIGN IN ALPHA PRECISION DRAFTING INSTRUMENTS

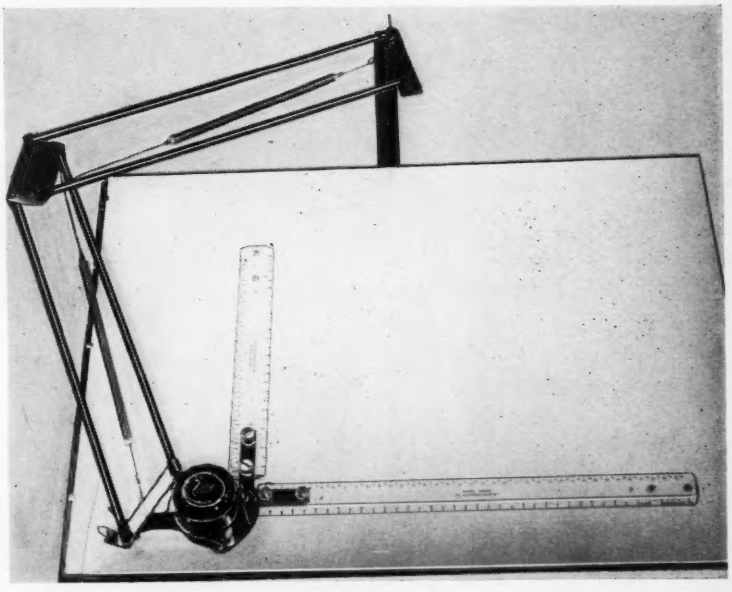
Featuring the revolutionary new QUICK-SET Giant Bow (see inset), the new Alpha 11/88 has the additional advantages of heavy **chrome** plating, and a metal non-warp case.

$19.75



TAKE ADVANTAGE of this special combination offer to readers of Design Engineering.

At the recent National Industrial Production Show interest was so great in these two items that we are offering a Design Engineering summer combination special. Purchased individually these items would cost $49.75; during June and July the special combination price is $39.95. Available from any ALPHA-Castell dealer shown at left, or contact Carsen Instruments Limited for the dealer in your area.



SWAN

AN AUXILIARY MACHINE FOR THE DRAFTING OFFICE . . . AN IDEAL TOOL FOR THE HOBBYIST . . .

All the features of a full size drafting machine including base-line adjustment, odd angle settings, and 15° click stops. A Swedish precision instrument, it is light-weight, compact and portable. For drawings up to 24 x 36 inches. Complete with set of architects' or mechanical scales, transparent plastic or white edged Venezuelan boxwood.

$30.00

HELPS THE HAND THAT SHAPES THE FUTURE . . .

CARSEN INSTRUMENTS LIMITED

162 Bentworth Ave. Telephone RU. 9-2681 Toronto, Ont.

For further information mark No. 114 on Readers' Service Card

Technical literature

Precision gears and clamps—Catalogue of precision gears and instrument clamps. Perfect Gear and Instrument Corporation.
Circle 300 on Reader Service Card

Hydraulic filters — 8-page bulletin describing first aircraft hydraulic filters made to requirements of specification MIL-F-8815. Filters rated at absolute 15 microns. Aircraft Porous Media, Inc.
Circle 301 on Reader Service Card

Medium-voltage starters — Brochure describing completely re-designed medium-voltage starters for a-c motors. Provides short-circuit protection and coordinated control for squirrel-cage, synchronous, and wound-rotor motors up to 3,000 hp rated from 2,300 to 4,600 volts. Canadian General Electric.
Circle 302 on Reader Service Card

Pneumatic controllers — Bulletin specifying a new line of A/D pneumatic controllers for automatic control of pressure, temperature, flow, humidity and differential liquid level. Bristol Company of Canada.
Circle 303 on Reader Service Card

Liquid blending — Bulletin detailing proportioners and new concepts in continuous line blending. Blackmer Pump Company.
Circle 304 on Reader Service Card

Tunnel diode circuits — 16-page handbook on circuit design of tunnel diode with theory on tunneling action. Transitron Electronic Corp.
Circle 305 on Reader Service Card

Cable breakout boxes — Catalogue describing new line of cable breakout boxes for operating circuit tests. W. Hobson & Associates.
Circle 306 on Reader Service Card

Water treatment — Reprint on selection of the proper type of water treatment equipment for use at different boiler pressures and with different types of water. Graver Water Conditioning Co.
Circle 307 on Reader Service Card

Cold drawn tubing — Charts listing production limits for ultra-thin welded tubing in cold drawn and bead reduced forms. Western Pneumatic Tube Co.
Circle 308 on Reader Service Card

Telemetry switch — Bulletin describing microminiature 450-circuit telemetry switch. Electro-Tec Corp.
Circle 309 on Reader Service Card

Hydraulic power units—Bulletin giving application details on single, double and booster pump models. TEM Sales Co.
Circle 310 on Reader Service Card

Technical literature— *(Continued)*

Set screws—Bulletin describing line of screws with nylon insert to prevent burring of precision shafts. PIC Design Corporation.
Circle 311 on Reader Service Card

Military specifications—Catalogue referring to over 450 specifications in lubrication, hydraulics and corrosion prevention. Bray Oil Co.
Circle 312 on Reader Service Card

Glass drainline—Revised 16-page catalogue listing data and available fittings for corrosion-resistant system for disposal of chemical wastes. Corning Glass Works.
Circle 313 on Reader Service Card

Steel-bonded carbides—Manual on machinable steel-bonded carbides. Chromalloy Corp.
Circle 314 on Reader Service Card

Chemical separation — Pamphlet describing new support for electrophoretic separations of chemicals with thin microporous cellulose acetate sheet. Gelman Instrument Company.
Circle 315 on Reader Service Card

Valve sizing — Four-page chart simplifies sizing of regulator and control valves. OPW-Jordan Corp.
Circle 316 on Reader Service Card

Pressure regulator — Bulletin describing a precision device for laboratory test applications. Canadian Meter Company Ltd.
Circle 317 on Reader Service Card

Selecting contact devices — 12-page bulletin aiding selection of contact devices and impulse generators for demand applications. Canadian General Electric Company Ltd.
Circle 318 on Reader Service Card

Platinum resistance sensors—Booklet describing combination of a carrier amplifier and a platinum resistance sensor for recording temperatures from minus 320 to plus 2000 degrees F. Bayly Engineering Limited.
Circle 319 on Reader Service Card

Refrigeration and air conditioning—12-page catalogue of a full line of automatic components for refrigeration and air conditioning for industrial and domestic use. Danfoss Manufacturing Company Limited.
Circle 320 on Reader Service Card

Laminated plastics — Condensed catalogue simplifying selection and application of laminated plastics and vulcanized fibre for electrical, electronic and mechanical components.
Circle 321 on Reader Service Card

Diaphragm motor valves — Bulletins on diaphragm motor valves for on-off or pressure reducing service. Canadian Meter Company Ltd.
Circle 322 on Reader Service Card

Nylon stock shapes — Bulletin describing nylon formulation with new mill shape availabilities. Polypenco Inc.
Circle 323 on Reader Service Card

Lift trucks — Catalogue describing new single-stroke mechanical hand lift trucks. Zeus Manufacturing Limited.
Circle 324 on Reader Service Card

Timing screws — Brochure describing custom-engineered timing screws. Arthur Colton Company.
Circle 325 on Reader Service Card

Variable speed belts—Interchange guide listing dimensions of variable speed belts. Manheim Manufacturing & Belting Co.
Circle 326 on Reader Service Card

Midget air cylinders — Bulletin providing data and specifications on new maximum 200-psi midget air cylinder. TEM Sales Company Limited.
Circle 327 on Reader Service Card

Canada's Design Council streamlined

DE's Ottawa correspondent Richard Gwyn reports . . .

The Commons, in double-quick time, debated and passed the bill to re-vamp Canada's National Industrial Design Council.

Basically, the legislation is aimed at upgrading the functional side of the Design Centre's work at the expense of the artistic. It also puts the council on a more formal and permanent basis, opening the way for closer co-operation with manufacturers.

During the debate, Trade Minister George Hees explained the reason for moving the council from the National Gallery to his department: "With the present state of competition in markets both at home and abroad, Canadian industry cannot afford to ignore design as a basic competitive factor. Canada's competitors are fully aware of this.

"Basic design thinking, from choice of raw materials to the method of production, the actual product design and the manner of packaging, can result in a better product in terms of cost to the producer and in terms of function and appearance to the purchaser. This is an enormous field and full co-operation among manufacturers, distributors, consumers and government is needed if we are to achieve the desired results."

Design criticized

Harold Winch (CCF — Vancouver East) said there was general criticism about the lack of research and design in Canada. He said: "The council is going to be obliged to exert every possible bit of influence on industry which unfortunately, in the past, has wanted to sit back and hope that its profits will continue."

Gordon Aiken (PC — Parry Sound-Muskoka) said there was unfortunately an impression that Canadian-made goods were lacking in imagination. He cited furniture, silverware, toys and novelties as goods "which were fully capable of manufacture in Canada, but which have fallen behind many other countries in the matter of design, appeal and something new."

Mr. Aiken hoped council membership would not be given only to "stolid, traditional types." He suggested that along with representatives of business and government, "three or four crackpots" be included so every bright idea would not be immediately squashed.

What's new?

Provisions of the bill include:

- A change in the make-up of the council to bring in a higher proportion of manufacturers, retailers and wholesalers. Membership will total 20.
- New emphasis on liaison with industry, especially manufacturing, and close co-operation with such bodies as the Canadian Manufacturers' Association. Study groups will be formed to co-operate with other industrial associations.
- Expansion of the Design Awards program with special attention to attracting as wide as possible a selection of entries from manufacturers.
- Increase in the number of exhibitions, particularly traveling exhibitions.
- Featuring of award winners at trade and industrial fairs throughout Canada and abroad.
- Increase in both budget and staff. ★

New products and materials

New potentiometers

A new industrial potentiometer is on the market incorporating an accurate, electromechanical strain gauge as the rebalancing element. The number of points at which the instrument can come to balance are not limited to the turns on a slidewire. **Honeywell Controls Limited.**

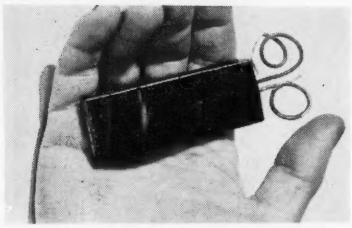
Circle 328 on Reader Service Card

Continuous strip switches

A strip switch ¾ inch wide and one-eighth inch thick is now available in fifty feet rolls to close a circuit when a pressure of 8 ounces is applied. It can be cut to any length and shears and end terminals are easily fitted. Switch is also available for a closing pressure of 40 ounces. **L. J. Bardwell Company.**

Circle 329 on Reader Service Card

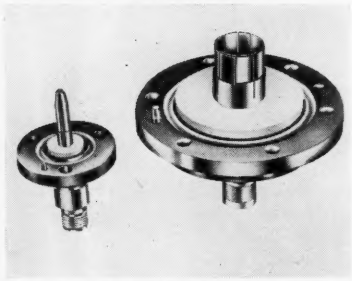
High rating battery



A silver chloride magnesium battery claimed to have the highest watt hour rating per cubic inch. Suitable for use in missiles, ship buoys and marine life jackets, it will keep a 1.3 volt flashlight burning for 72 hours. Unit weighs only 2 oz. dry. **Peerless Roll Leaf Co.**

Circle 330 on Reader Service Card

Coaxial transitions



New coaxial to coaxial transitions designed as compact lightweight devices for both systems and laboratory use. With the utilization of unique matching techniques, these units feature short insertion length. **Electrodesign.**

Circle 331 on Reader Service Card

New circuit breaker

A new circuit breaker mechanism permitting assembly of two independent poles side-by-side in the standard one-inch width of molded housing has been introduced. The resulting duplex breaker incorporates all the best electro-mechanical features of single pole circuit breakers. **Canadian Westinghouse.**

Circle 332 on Reader Service Card

Small relay

A new small relay is now available only slightly larger than one cubic inch. It has operated under a light load in excess of 100 million cycles with less than 5% variation in electrical characteristics. **Potter & Brumfield Canada Ltd.**

Circle 333 on Reader Service Card

Magnetic regulator

A series of magnetic regulators for silicon controlled rectifiers. They are capable of controlling the leading edge of the gate voltage wave over a range of 0 to 180 deg. **The Glendon Co.**

Circle 334 on Reader Service Card

Airless pump

A new compact lightweight airless pump with 5 gallon capacity and weighing 17 lbs. With 26-1 ratio, it will operate with air pressure produced by as small as a 1 h.p. compressor. **DeVilbiss (Canada)**

Circle 335 on Reader Service Card

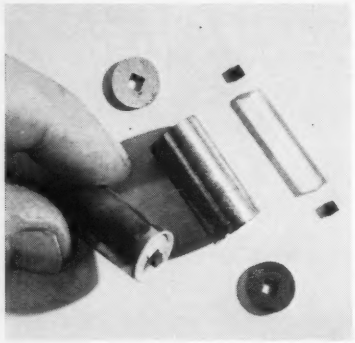
New products and materials — *continued*

Photo-electric actuator

A rugged versatile photo-electric actuator for counters and other devices which accept on-off signals. Sensitive enough to be used as a smoke alarm the unit has an aluminum die cast housing that is oil, dust and splashproof. The light beam has a built in intensity adjustment and adjustable focus ranging from 3¾ in. focal length and 5/16 in. focal size to 1½ in. dia. straight light beam. **General Controls Co. (Canadian) Ltd.**

Circle 336 on Reader Service Card

Ultrasonic transducer



A new device for converting electrical energy into ultrasonic energy at microwave frequencies. A piezoelectric transducer, it uses a semiconductor depletion layer. Applications include ultrasonic delay lines where operation at high frequencies and wide band width catches will make it possible to store large amounts of information. **Bell Telephone Laboratories.**

Circle 337 on Reader Service Card

Polyethylene pipe

A polyethylene pipe engineered to precise standards is now available for cold water applications. Claimed to be designed for a life of thirty years it comes in three types with working pressures of 75, 100 and 120 psi. The pipe-making material was developed in Canada by Du Pont and is manufactured under licence. The price to the trade will be eight per cent lower than existing prices for polyethylene pipes. **Page-Hersey Tubes Limited.**

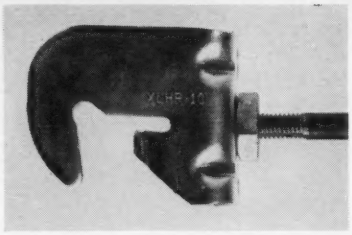
Circle 338 on Reader Service Card

Governed dc motors

A new series of chronometrically governed dc motors with exceptionally high accuracy and long life at constant speed independent of load line and temperature variations. Suitable for applications requiring low current drain such as operating contacts, cams and actuators. **Philips Electronics Industries Ltd.**

Circle 339 on Reader Service Card

Hanger adapter



A new hanger adapter claimed to reduce duct hanging time by up to 50% and eliminate need for bracket fabrication. When the adapter is bolted to the suspension rod end, the adapter hook engages instantly to duct with standard hangers. Secure installation is achieved by spin-tightening the hanger bolt. **ITE Circuit Breaker (Canada) Ltd.**

Circle 340 on Reader Service Card

Ceramic magnet

A ceramic magnet with minimum coercive force of 3,000 oersteds. Possible applications include magnetic couplers, motors, generators and other devices which must withstand low temperatures and strong demagnetizing forces. **Glendon Company Ltd.**

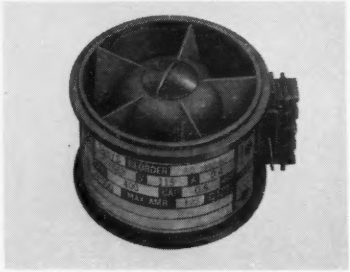
Circle 341 on Reader Service Card

Transistor tester

A new transistor tester capable of measuring AC Beta with an accuracy of plus or minus 5%. Using a method which neutralizes circuit impedance before tests are made, it is claimed to eliminate certain inaccuracies. With circuit impedances as low as 150 ohms, an AC bridge principle effectively removes transistor input elements from the circuit as a factor in Beta measurement. **Stark Electronic Sales Co.**

Circle 342 on Reader Service Card

High capacity fan



A compact high capacity fan available with a servo-ring mount. Use of the mount with the fillister head screws permits the user to remove the fan at any time by loosening the screws and slipping the servo-ring out from under the screw assemblies. **The Hoover Co.**

Circle 343 on Reader Service Card

Null indicators

New miniature and edgewise null indicators have been introduced that will read large amounts of unbalance in bridge or other detection circuits without damage to the instrument. **Honeywell Controls Ltd.**

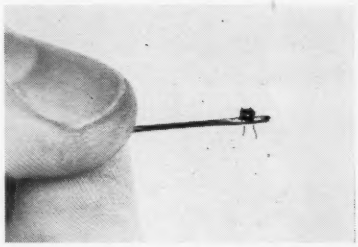
Circle 344 on Reader Service Card

Small directional valves

A new line of miniature directional valves has been developed for oil hydraulic systems. They are suitable for operation to 1,000 psi and have a maximum capacity of 2 gpm. **Vickers-Sperry of Canada Ltd.**

Circle 345 on Reader Service Card

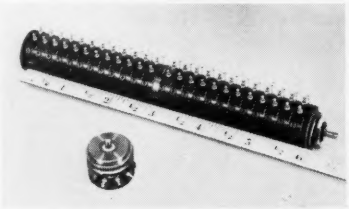
Smallest resistor



Believed to be the world's smallest resistor measuring only one-sixteenth by one-sixteenth of an inch. Of the wire-bound type, it is available in resistive values from 1 ohm to 50 K. The units can be manufactured with power ratings 0.02 watts. **Reon Resistor Corporation.**

Circle 346 on Reader Service Card

Series potentiometer



A series potentiometer allowing as many as 24 precision rotary potentiometers to be ganged on a single shaft in a length of only 6 in. Individual potentiometers making up a ganged series can also be adjusted without affecting adjoining pots. **Daystrom Ltd.**

Circle 347 on Reader Service Card

Spiral wrap hose

A large diameter high pressure hose ideal for hydraulic systems requiring 1¼ to 2 in. hose sizes with working pressures up to 3,000 psi. Hose has a synthetic inner tube with alternating layers of spiral wire wrapping and synthetic rubber. **Aeroquip Canada Ltd.**

Circle 348 on Reader Service Card

People . . .
. . . and events

Fluid Power Society extends to Montreal

J. J. Pippenger, Director of the Fluid Power Society, presents the charter for the Montreal chapter to H. Maisoneauve. A. D. Kaill, editor of DE, and a Director of the Society, is at extreme left.

Canada's second chapter of the Fluid Power Society has opened in Montreal. Thirty-seven manufacturers, distributors and users of fluid power equipment attended a recent meeting in the Mount Royal Hotel to cast a unanimous vote in favor of the formation.

The meeting elected a steering committee to take the reins until a permanent executive is installed. Members are: H. Maisoneauve, K. Weaver, A. C. Blackburn, F. Lorer, K. C. Dawson, F. Rousseau, W. R. Geiger, A St. Pierre and H. A. Cowan who will act as chairman.

Guest speakers were J. J. Pippenger, vice-president of Doubla A Products in Manchester, Michigan, and A. D. Kaill, editor of Design Engineering. Both are Directors of the Fluid Power Society and Mr. Kaill has been charged with the organization program in Canada.

DE's Montreal representative, C. E. Laws chaired the inaugural meeting.

1,000 words a minute

Data was transmitted at 1,000 words per minute over a regular dial telephone network between Chicago and Los Angeles in a demonstration last month.

The feat was performed by a new system developed by Digitronics Corporation.

The demonstration began with an ordinary telephone call from Chicago. When the connection was made, data was transmitted for half an hour, coming out at Los Angeles in the form of punched paper tape. Several other demonstrations included a link between Denver and New York.

The speed of 1,000 words per minute is claimed to be ten times faster than anything yet achieved over a regular telephone network. In addition to transmitting, the system also checks for errors.

Design contest closing

Deadline for entries in the annual design contest sponsored by Gray Iron Founders' Society is July 15. Seven prizes are offered including first prize of $500.

Anyone who has designed a gray or ductile iron casting is eligible to enter. Designs will be judged on functional qualities, cost, appearance, or general commercial importance. Redesigns or conversions should show definite product improvement.

Results will be announced at the annual meeting to be held this fall in Toronto. DE's editor A. D. Kaill, P.Eng. is chairman of the judging committee.

Appointments

Albert Joedicke promoted to president and general manager of United Steel Corporation, Ltd.

A. C. Moore elected vice-president of Ford Motor Company of Canada, Ltd.

W. P. O'Malley appointed to the permanent staff of the Corporation of Professional Engineers of Quebec as specialized services officer.

Lee E. Elfes promoted director engineering, North America, at Massey-Ferguson Limited.

John J. Sales joins Morse Chain of Canada Ltd. as general manager.

Thomas J. H. Tatnall appointed chief engineer of Richards-Wilcox Canadian Co. Ltd.

"Come in, Fenwick. We've been getting a laugh out of your design."

Armand Fromanger to head new silicon rectifier department of Syntron (Canada) Ltd.

B. Richard Lewis appointed chief engineer at Omark Industries Ltd.

Fromanger

Sales

Moore

O'Malley

Andre Grenier promoted manager of the Montreal office of Master Builders Company.

New degree courses

The Association of Professional Engineers of Ontario has accredited fourteen new engineering degree courses.

Three new universities will be recognized for the first time. They are Carleton University at Ottawa, Essex College of Assumption University at Windsor and McMaster University at Hamilton.

Also accredited is the industrial engineering course at the University of Toronto.

The Professional Engineers' Founda-

(Continued on page 72)

People . . .
. . . and events
(Continued)

tion for Education will award scholarships covering the first year university fees of grade 13 students entering an accredited university course at each Ontario university.

Powder metal award

The first "pioneer award" of the powder metallurgy industry has been given to Roland P. Koehring, section engineer in charge of research at the Delco Moraine Division of General Motors in Dayton, Ohio.

Award was made by the Metal Powder Industries Federation for "advancing powder metallurgy from a laboratory technique to an industrial process." Mr. Koehring has just retired after 40 years in research with General Motors.

New analysis service

A new engineering analysis service is being offered by Avro Aircraft Limited, Toronto.

Calling on its staff of engineers with experience in structural and mechanical design, the company plans to offer advice on streamlining operations to increase profit. Engineering reports with results and recommendations arising from Avro's investigations are provided as part of the service.

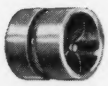
Chief stress engineer Henry N. Shoji P.Eng., is in charge of the new project.

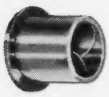
New magnet firm

A new company has been formed in Toronto to manufacture permanent magnetic equipment for iron separation, automation, and vibratory feeding.

It is Eriez of Canada Ltd. which will locate in new premises at 133 Oakdale Road, Toronto.

CENTRIFUGAL BRONZE BARS or Precision Finished Bronze Bushings





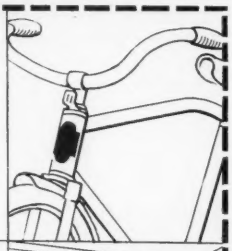
■ ROTO-CAST assures you of bearings that are free from porosity, microshrink and blow holes. Our precision machining gives you bushings that are of close tolerance, concentricity and fine finish. ROTO-CAST is a high quality bar — the most economical for maintenance or production.

Write for our technical literature.

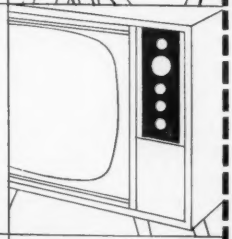
THE CANADA METAL COMPANY LIMITED
721 EASTERN AVE., TORONTO 8 HO. 5-4684
Contact our nearest Branch
MONTREAL SCARBOROUGH WINNIPEG CALGARY VANCOUVER

For further information mark No. 112 on Readers' Service Card

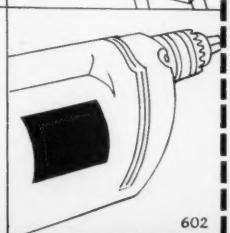
Save up to 60% and enhance appeal!



with vibrant self-adhesive
AVERY METALLICS



for
NAMEPLATES
FUNCTIONAL PARTS
TRIM MATERIALS



602

DECORATIVE PRODUCTS DIVISION
AVERY ADHESIVE LABEL
48 HAAS RD., REXDALE, ONT.
5369 QUEEN MARY RD., MONTREAL, QUE.
WINNIPEG • VANCOUVER

For further information mark No. 104 on Readers' Service Card

R&M 48

RERATED FRACTIONAL H.P. MOTORS
1/20 THRU ¾ H.P.

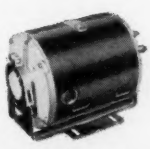
R & M Frame 48 Motors are packed with competitive advantages for your product!

It's a dynamic motor — smaller, lighter, more versatile — engineered to give your product every competitive advantage when it comes to power. Designed for superior performance and long, trouble-free life under the most exacting conditions.

Lightness and compactness are due to selective use of lighter metals and more efficient ventilation.

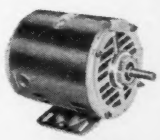
Available up to ½ hp. 1725 rpm. single phase, and ¾ hp. 1725 rpm. polyphase. Protected or totally enclosed, rigid or resilient mount.

- **Easy access terminal box**
- **Dependable, silent centrifugal switch**
- **Precision machined rigid steel shell**
- **Light weight die-cast aluminum end heads**
- **Precision die-cast aluminum rotor**
- **Choice of rigid or resilient mountings**



SPLIT PHASE

CAPACITOR START



POLYPHASE

Off-the-shelf availability gives you design versatility as well! You are offered a wide choice of mountings, bearings, mechanical and electrical characteristics.

R&M Frame 48 motors are manufactured under strict quality control to assure reliability. Custom engineered and designed motors are also available for any specific requirement.

For more detailed information, write today for Motor Bulletin 2005.

THE ROBBINS & MYERS COMPANY
of CANADA LIMITED—BRANTFORD, ONTARIO

For further information mark No. 138 on Readers' Service Card

backlash

Using the wrong bait

The keen demand for competent trained engineers throughout North America puts the job-hunter in the driver's seat, yet still too few companies seem prepared to go out of their way to woo the suitable applicant.

Recently New York Times' columnist Robert Rubber reported an experiment by a U. S. professional recruitment agency that sent out one hundred dummy replies to companies advertising for electrical engineers. All had advertised within a specific two weeks' period and all had shown evidence of a sustained recruiting effort over the preceding six months. For its resumes the agency created an imaginary applicant with a master's degree, nine years' professional experience and responsibility as a group leader in advanced research and development.

Within twenty-five days only 85 companies had replied, half of them taking more than a week. Only 17 saw fit to wire. Considering that placement agencies estimate job-hunting engineers make from five to seven contacts a week, the slower companies show little hope of clinching the deal.

Eighteen companies replied with form letters, at least ten were signed by secretaries (one was not signed at all) while misspelling and grammatical errors added insult to injury. Stamped addressed envelopes were enclosed in only 22 cases, and as few as two tried to lure the applicant with information on location or working and living conditions.

It is hard to imagine, that in an age of slick merchandising competition, a company can be so ignorant or complacent as to neglect trying to sell itself to the talented professional. Perhaps it's time for a renaissance when industry should reassess the role played by an educated man, before the machine assumes command in the realm of human initiative.

The import problem

A hot war is boiling up between the Canadian Importers and Traders Association, who would prefer to have unlimited importation, and those who would restrict the flow of products into Canada. Take the case of electronic tubes and other equipment, for instance.

The Association, in a recent bulletin, stated, "If we examine the import statistics of radio and television tubes for the past three years we find that the total dollar value of imports from all countries has remained fairly constant. However, we find that the increase in imports from Japan each year is approximately equal to the decrease in imports from the U. S. What is happening is that there is a shift in trade from the USA to Japan. From the point of view of our balance of trade this is good, since we incur a large deficit in trade annually with the USA while we have a surplus trading balance with Japan."

All this may be somewhat near the truth . . . but the real facts are revealed only when we look at the quantities and types of tubes involved, and not the dollar value. The Electronic Industries Association has pointed out that most of the tubes we buy from the USA are specialized types not made in Canada, and therefore no work is lost to Canadians. On the other hand, the tubes imported from Japan are identical to the types which Canadians have been manufacturing.

The increase in value of tubes from Japan represents a total quantity increase of 3.7 million units, based on a unit value of 31 cents. But the comparable dollar decrease in USA imports represents only 1.6 million units, since the unit value of each tube is about $1.19. The relative importance of these two figures to Canadian industry is obvious.

Business or profession?

One of the questions that engineers in the United States will have to square up to in the near future is whether they want to be called professionals or businessmen.

The matter has been given a new airing with the drafting of the so-called Model Law for engineering practice as set forth by the National Council of State Boards of Engineering Examiners. One of its provisions will permit formation and practise of an engineering firm when only one member of the firm is a registered engineer.

Objection has been lodged by the American Society of Civil Engineers on the grounds that such a provision will be contrary to the best interests of engineers. The Society is in no doubt as to the standing of either business or professions . . . it agrees both are honorable callings. But it points out that the recognized professions of law and medicine, which do not permit corporate practice, are accepted by the public as professions because of the actions of individuals within their ranks.

One thing is sure. Engineers, too, will be judged by their actions, no matter what they call themselves. Once they place money before service their professional standing will be in jeopardy.

Canadian engineers would do well to watch the outcome, as this is a problem they too may have to face in the not too distant future.

Inventors awake

Nearly every engineer in Canada has at least one practical "get-rich" idea that should be followed up and developed.

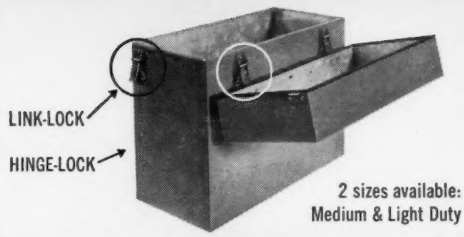
Working on this assumption, a private group within the Professional Engineers' Association of Ontario is prompting formation of a committee to speed the flow of patentable ideas. Group members have expressed alarm at the lack of designs, processes and inventions currently originating in Canada.

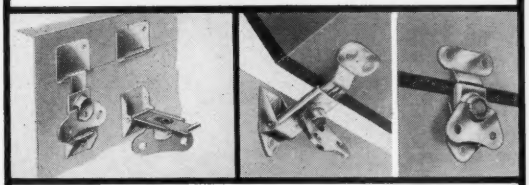
Objectives of the proposed committee would be to:

- Seek out, develop and promote worthwhile ideas and inventions among Association members.
- Act as a clearing house for evaluation of ideas.
- Establish a registration system for protecting the inventors' rights.
- Manage royalty agreements or sale of new developments.
- Recommend how funds could be raised for development of feasible ideas for which no purchaser can be found.

The group hopes its suggestions will encourage manufacturers to look beyond their own offices for the ideas they need to replenish reserves of energy and productiveness.

Matched hardware for all-around pressure on hinged-cover containers!





LINK-LOCK provides high-strength, pressure-tight seal without springs. A half-turn disengages for opening.

HINGE-LOCK permits application of sealing pressure along hinge line; becomes free-operating hinge when released.

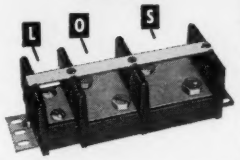
SEND TODAY for complete information.
Engineering service available • Samples on request

SIMMONS FASTENER CORP.
1776 North Broadway, Albany 1, New York

For further information mark No. 139 on Readers' Service Card

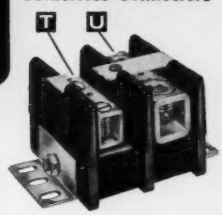
NEW, IMPROVED! CURTIS High Current Terminal Blocks

Types "L", "O" and "S"
for Wires or Cables with lugs.



- Nickel plated copper terminal bars for good conductivity.
- Type "L"—750 Volts 100 Amp. Capacity, for up to AWG No. 1 wire—1 to 12 terminals.
- Type "O"—750 Volts 125 Amp. Capacity, for up to AWG 1/0 wire—1 to 4 terminals.
- Type "S"—750 Volts 225 Amp. Capacity, for up to AWG 4/0 wire—1 to 4 terminals.
- White Fibre Marking Strips.

Types "T" and "U"
With High Pressure Solderless Connectors



- 750 Volt 125 Amp. and 250 Amp. Capacity.
- 100% pure electrolytic copper tubular connectors provide 100% conductivity.
- Wire clamping screws give positive and completely positioned connection.
- No expensive lugs—no lug assembly time required.
- Type "T" for AWG #6 to 1/0 wire, 1 to 6 terminals.
- Type "U" for AWG #4 to 250 MCM wire, 1 to 4 terminals.
- White Fibre Marking Strips.

Request Canadian Catalogue C-60

Produced in Canada by:

A. C. SIMMONDS & SONS, LTD.
96 Merton Street, Toronto 7

For further information mark No. 117 on Readers' Service Card

Fabrication...

For instance, Crane Packing Company's new Teflon products plant was especially designed to obtain the highest quality fabrication of this material and includes the very latest in extruding, molding, curing and machining equipment. Result: *parts and components that retain all of Teflon's outstanding electrical, mechanical, anti-corrosive, heat-resistant and other properties.*

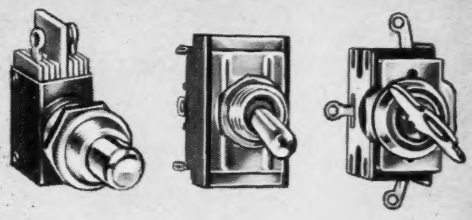
Whether *you* get this quality depends on your selection of a fabricator. Why not choose the best?

Contact us about your requirements.
Request Bulletin T-110.

**DuPont Trademark*

John Crane
CRANE PACKING COMPANY, LTD.
OFFICES IN PRINCIPAL CANADIAN CITIES
Box 134, Station C, Dept. ATP, Hamilton, Ontario

For further information mark No. 116 on Readers' Service Card



There's a small, compact ARROW-HART SWITCH CONTROL for every electronic application!

Arrow-Hart offers a complete range of quick make, quick break switches for radio and electronic equipment and all your small motor control requirements. Send for your copy of the new, illustrated Bulletin Z-12 today.

ARROW AH HART

ARROW-HART & HEGEMAN (CANADA) LIMITED

INDUSTRY STREET, TORONTO 15, ONTARIO
7365 MOUNTAIN SIGHTS, MONTREAL, QUE.
Quality MOTOR CONTROLS • WIRING DEVICES • APPLIANCE SWITCHES

6004-R

For further information mark No. 101 on Readers' Service Card

Editorial

The 1961 Stainless Steel Design Awards

. . . heading for another year of knocks?

Apparently there are still some people and organizations who do not feel it wise to profit by their mistakes . . . take for instance, the case of the Stainless Steel Design Award Committee.

The basic purpose of the Committee, we believe, is to foster better Canadian designs in stainless steel, so that more stainless will be marketed. One technique that the Committee has adopted is to sponsor design contests. This year the industrial giants behind the Committee have offered cash awards totaling $10,000 to the winners.

But before we look at this year's contest, let's review what happened last year. In 1960 the contest consisted of photographs of designs in stainless. It was open to anyone, anywhere. The winning photographs were to be placed on an exhibition tour of Canada.

The contest certainly did not stimulate Canada's industrial designers. Although a number of Canadian architectural applications were selected (the professional adviser to the Committee is a professor of architecture) not one single Canadian consumer product received even an honorable mention . . . in fact, there were few, if any, entered.

It might even be said that the Canadian industrial designers boycotted the contest. They objected (and quite justifiably) to a number of the conditions of the competition, and we feel quite certain that the sponsors were fully aware of the facts. We assumed that they would have learned a most important lesson.

Now let's look at what is happening again this year. The announcement of the 1961 contest says, in part:

The Stainless Steel Design Award Committee . . . announce a design competition for a Branch Bank with awards totaling $10,000 in two categories:

Category 1—Design Concept — open to Canadian Architects and Graduates of Commonwealth Schools of Architecture.

Category 2—Components and Accessories — open to Canadian Designers, Artists, Manufacturers, as well as Architects.

This statement, on the surface, seems innocuous enough. But let's examine it closely and pose a few questions. Why, for instance, is category 1 restricted to Architects? Engineers have been known to create some excellent architectural designs . . . and indeed, some housewives have a good idea or two on the subject. Are our architects afraid of competition?

Again, if category 1 is to be restricted to one professional group, should not category 2 be handled the same way and restricted to professional industrial designers?

We would suggest that both categories be thrown wide open to anyone . . . and let the professionals take their chances with the so-called untrained. The results might be very interesting.

The jury in category 2 consists of two architects and one interior decorator. Why are no designers or engineers included? Surely they would be the most qualified to fill the job.

Why was a bank building chosen for the subject? We can think of dozens of other fields of design where the potential for stainless is much greater.

After the Committee invited the professional industrial designers to submit recommendations relative to the proposed contest, why did the Committee organize the event opposite to the designers' recommendation?

The contest in its present form appears to be headed for a rougher road than it traveled last year. Fortunately, it is still not too late to make some revisions . . . but we doubt that the advice will be heeded. And the fault seems to be that the Committee is caught up in an unhealthy marriage with a certain school of architecture and its venerable professor. Perhaps it is time for a divorce.

Doug Kaill

Use these cards to get additional information... promptly... conveniently

Every advertisement, new product, and catalogue listed in this issue of DESIGN ENGINEERING has been key numbered.

To secure information and literature just circle the proper number on the cards . . . complete and mail . . . we contact the companies for you and pay all the postage.

There are three identical cards . . . pass this copy on so your friends can order material of their choice, too.

This service is FREE . . . make the most of it.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada

POSTES — CANADA — POSTAGE
5 CENTS
6263

Design Engineering

481 University Avenue

Toronto 2, Canada

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada

POSTES — CANADA — POSTAGE
5 CENTS
6263

Design Engineering

481 University Avenue

Toronto 2, Canada

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada

POSTES — CANADA — POSTAGE
5 CENTS
6263

Design Engineering

481 University Avenue

Toronto 2, Canada

Design Engineering — June 1961

Please send me more information on the following circled items:

101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136
137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154
155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172
173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190
191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208
300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317
318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335
336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353
354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371
372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389

PLEASE PRINT or TYPE **CARD INVALID WITHOUT COMPANY NAME**

Name ..... **Position** .....

Company .....

Address .....

.....

Products manufactured .....

Send DESIGN ENGINEERING for 1 year ($5) ☐ or 2 years ($9) ☐ and bill me later. Outside Canada rates: Great Britain & USA $10 per year—Other countries $20 per year (remittance with order). Please initial .....

Design Engineering — June 1961

Please send me more information on the following circled items:

101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136
137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154
155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172
173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190
191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208
300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317
318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335
336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353
354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371
372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389

PLEASE PRINT or TYPE **CARD INVALID WITHOUT COMPANY NAME**

Name ..... **Position** .....

Company .....

Address .....

.....

Products manufactured .....

Send DESIGN ENGINEERING for 1 year ($5) ☐ or 2 years ($9) ☐ and bill me later. Outside Canada rates: Great Britain & USA $10 per year—Other countries $20 per year (remittance with order). Please initial .....

Design Engineering — June 1961

Please send me more information on the following circled items:

101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136
137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154
155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172
173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190
191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208
300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317
318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335
336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353
354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371
372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389

PLEASE PRINT or TYPE **CARD INVALID WITHOUT COMPANY NAME**

Name ..... **Position** .....

Company .....

Address .....

.....

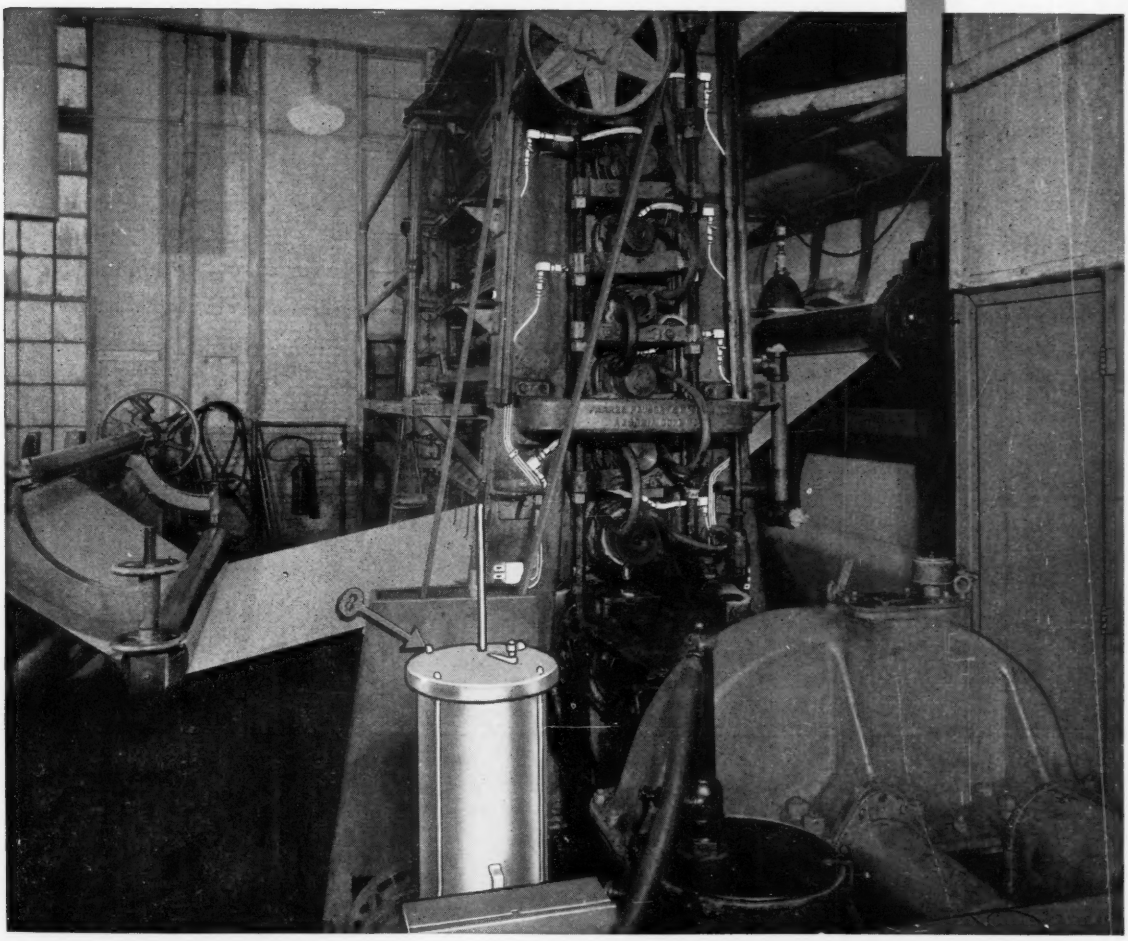
Products manufactured .....

Send DESIGN ENGINEERING for 1 year ($5) ☐ or 2 years ($9) ☐ and bill me later. Outside Canada rates: Great Britain & USA $10 per year—Other countries $20 per year (remittance with order). Please initial .....

ADVERTISERS' INDEX

Adequate lubrication, vital to life of Calender Stack, supplied by Farval

FARVAL—
Studies in Centralized Lubrication
No. 191



In producing 700 feet per minute of fine paper smoothly and continuously, this Calender Stack must have adequate lubrication of all bearings. Adequate means not only *sufficient* lubricant to keep bearings running cool and without drag, but also *just enough* lubricant to prevent dripping and spoilage of paper.

This particular Calender Stack at Hammermill Paper, Erie, Pa., is satisfactorily lubricated by a Farval Automatic System. Installed in 1947, there has not been a shutdown or delay due to faulty lubrication in 9 years.

Farval, the pioneer system of centralized lubrication since 1926, employs the famous Dualine principle. It insures correct delivery of oil or grease at all times to any number of bearings. For complete information, write for Bulletin 26-R. Peacock Brothers Limited, P. O. Box 1040, Montreal 3, Quebec. Branch offices in Sydney, Toronto, Sudbury, Winnipeg, Edmonton, Calgary and Vancouver.

KEYS TO ADEQUATE LUBRICATION—

Wherever you see the sign of Farval—the familiar central pumping station, dual lubricant lines and valve manifolds—you know a machine is being properly lubricated.

18 bearings on this Calender Stack are lubricated by Farval. Immediately in the foreground is the automatic central pumping station.

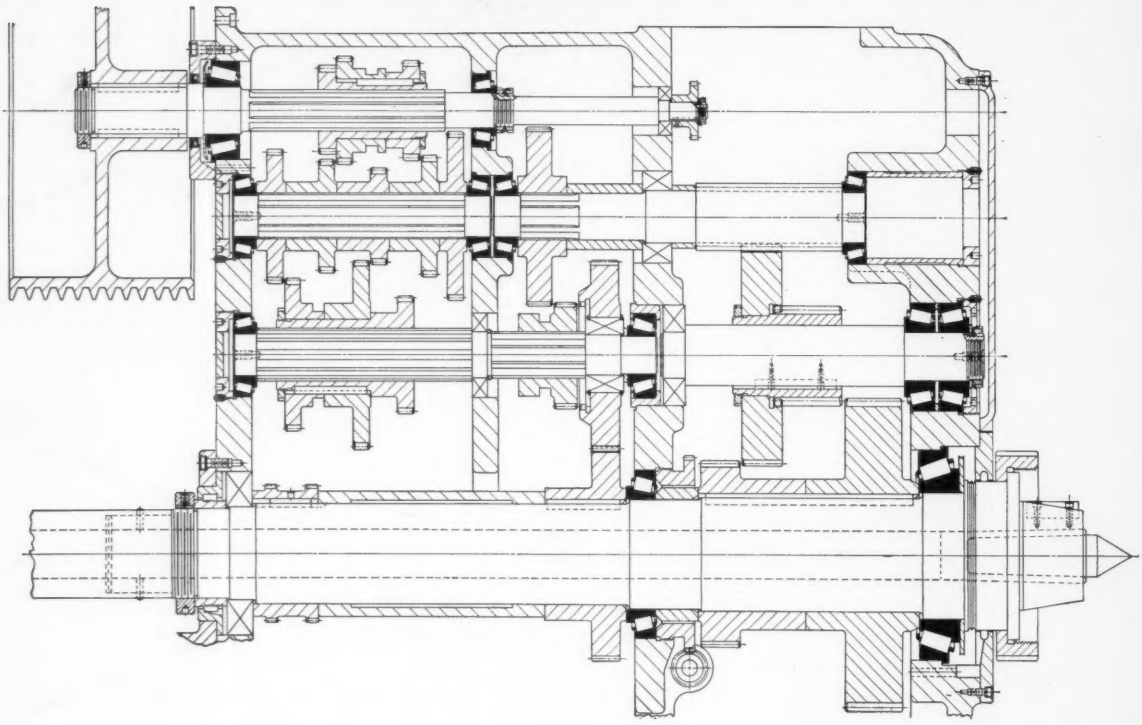
FARVAL
CENTRALIZED SYSTEMS OF LUBRICATION

Sold in Canada by...

PEACOCK BROTHERS LIMITED

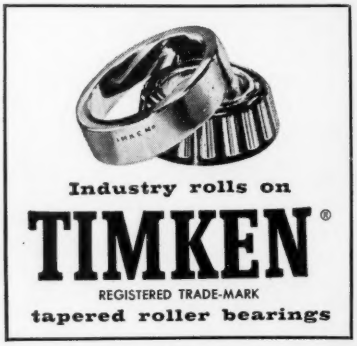
For further information mark No. 133 on Readers' Service Card

How world's largest tracer lathe assures precision



Engineers of The American Tool Works Co. design maintenance of high precision right into their new Maxi-Swing Tracer Lathe with 16 Timken tapered roller bearings on the nose and center of the spindle, drive and intermediate shafts. That's because Timken bearings are designed and manufactured to take the big loads from all directions of this machine cutting ¾" deep into work pieces of up to 40 tons. And they do it through a range of 22 speeds, giving rigidity with compact mounting and ease of assembly.

ON-THE-SPOT ENGINEERING SERVICE. Our sales engineers can help you right at the design stage to get the most economical bearing in terms of needed capacity and precision. Why not call them in early?



Canadian Timken, St. Thomas, Ontario, Canada. Division of The Timken Roller Bearing Company. Timken bearings manufactured in Canada, Australia, Brazil, England, France and U.S.A.

For further information mark No. 145 on Readers' Service Card